TECHNICAL MANUAL 1002

GUIDANCE ON PREPARING AN AIR QUALITY MODELING PROTOCOL

BUREAU OF AIR QUALITY EVALUATION
AIR QUALITY PERMITTING PROGRAM
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

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1.0 INTRODUCTION

1.1 Purpose of Document

This document presents a comprehensive overview of the preparation of an air quality modeling protocol. This document should be used by applicants for preconstruction air pollution control permits, initial operating permits for new major facilities, and for minor modifications or significant modifications to existing operating permits which require air quality modeling. It should also be used for other reasons such as enforcement actions where air quality modeling is required. The Bureau of Air Quality Evaluation (BAQEv) of the Air Quality Permitting Program within the New Jersey Department of Environmental Protection (NJDEP) is responsible for the review of modeling protocols and modeling analyses. **BAQEv requires the submittal and approval of a modeling protocol before an air quality modeling analysis is submitted.**

Guidance contained in this document is not applicable to optional modeling and risk assessments performed in support of an operating permit application as described in N.J.A.C. 7:27-22-8(d). Applicants for operating permits are referred to NJDEP's technical manual 1004 entitled "Risk Assessment for Operating Permits (Draft)." This guidance document is not intended to provide an all-inclusive description of the requirements of a modeling analysis because each modeling analysis is unique. The purpose of this guidance is to provide the framework for how the modeling analysis should be conducted.

Individuals responsible for conducting the air quality modeling analysis should at a minimum be familiar with the following U.S. Environmental Protection Agency's (EPA) documents: *Guideline on Air Quality Models [Revised]* (EPA, 1996), *New Source Review Workshop Manual [Draft] (EPA, 1990), Screening Procedures for Estimating the Air Quality Impact of Stationary Sources [Revised]* (EPA, 1992a), and the user's guide for each dispersion model. The applicant should work closely with the staff of BAQEv to assure that all modeling requirements are met.

Note that Technical Manual 1003 entitled "Guidance on Preparing a Risk Assessment Protocol for Air Contaminant Emissions" is available specifically for the preparation of risk assessment protocols. Contact the Office of Permit Information and Assistance at (609)292-3600 for additional information about this and other technical manuals or the Bureau of Revenue at (609)777-1039 to order copies. In the future BAQEv hopes to place this technical manual on the NJDEP Electronic Bulletin Board System (609-292-2006) in the DEP File Area so that it may be downloaded.

1.2 Purpose of an Air Quality Modeling Analysis

An air quality modeling analysis is used to demonstrate that criteria pollutants emitted from a source will not cause or significantly contribute to a violation of any state or federal ambient air quality standard or PSD increment. The regulatory requirements, including Prevention of Significant Deterioration (PSD) regulations, New Jersey regulations, non-attainment regulations, National Ambient Air Quality Standards (NAAQS), and significant impact levels are discussed in Section 3.0 and Appendix A. Air quality modeling analyses may also be required to:

$ determine if, for any pollutant, a concentration will exist that may pose a threat to public health or welfare or unreasonably interfere with the enjoyment of life or property (e.g. odor impacts),

$ evaluate sites for monitoring of ambient concentrations,

$ determine the effects on ambient concentrations at the Brigantine Division of the Edwin B. Forsythe National Wildlife Refuge Class I area as a result of emissions from a new or modified source,

$ provide in the analysis an estimate of the impact of growth projected as a result of a new source or modification and the effects of emissions from sources on soils, vegetation, and visibility (PSD).

1.3 Requirements Unique to New Jersey Department of Environmental Protection

The following policies are unique to the NJDEP:

$ For comparison with the New Jersey Ambient Air Quality Standards (NJAAQS), running averages are required for short-term averaging periods greater than 1-hour.

$ It is NJDEP's policy that when modeling for one criteria pollutant, all criteria pollutants for which emission increases are proposed should be addressed.

$ New Jersey has adopted as a guideline value and reference concentration the California one-hour average nitrogen dioxide standard of 470 $\mu g/m^3$.

1.4 Contents of an Air Quality Modeling Protocol (Overview)

The protocol should document in detail how the applicant proposes to execute the modeling analysis and present the results. The protocol must receive prior approval from NJDEP before a detailed modeling analysis is conducted and submitted. NJDEP will not accept a modeling analysis without a pre-approved protocol.

In general, a modeling protocol should contain the following information:

$ Regulatory Requirements, including a description of what federal and New Jersey regulations and guidelines apply to the proposed project;

$ Project Description, including a project overview, facility plot plan, and emissions and stack parameters;

$ Project Site Characteristics, including a land use analysis, attainment status, description of the local topography, a Good Engineering Practice (GEP) stack height analysis, and the meteorological data proposed for use in the modeling analysis;

$ Proposed Air Quality Analysis, including the proposed air quality model selection and justification for use, screening analysis, and the proposed methods for refined modeling.

$ Special Modeling Considerations, including the approach for addressing visibility/Class I area modeling, effects on soils and vegetation/growth analysis, cooling tower modeling, coastal fumigation, health risk assessment, fugitive emissions, deposition and odor modeling, if necessary;

$ Establishing Background Air Quality, including justification of the background air quality monitoring data to be used in the analysis and the need to model existing major sources; and

$ Presentation of Air Quality Modeling Results, including how maximum impacts, significant impact areas, compliance with ambient air quality standards, and PSD increments will be demonstrated.

Details about each of these items are found in Sections 3 through 9. Table 1-1 contains a summary checklist that can be used to assess the completeness of an air quality modeling protocol and analysis. NJDEP recommends that this checklist be reviewed by the applicant before the documents are submitted to the Department.

1.5 Protocol Submittal

It is recommended that the modeling protocol should be submitted at the same time the air permit application for the source is sent to NJDEP. As a general rule, BAQEv will not review protocols until an air permit application is received by NJDEP. Modeling protocols and analyses should be sent to:

Chief, Bureau of Air Quality Evaluation
New Jersey Department of Environmental Protection
Air Quality Permitting Program
P.O. Box 027
401 East State Street, 2nd Floor
Trenton, New Jersey 08625

1.6 Document Revisions

This document will be amended periodically to incorporate new modeling guidance and changes to the regulations. The first update was released in August 1994. This version of the document represents the second update to the original April 1992 document. It includes changes made to reflect promulgation of Supplement C to the Guideline on Air Quality Modeling and major revisions to N.J.A.C. 7:27-8 (Permits and Certificates) and 7:27-22 (Operating Permits). In the future, the document may need further revisions to incorporate the proposed ambient air standard for particulates with diameters less than or equal to 2.5 micrometers (PM-2.5), additional changes to 7:27-8, the proposed New Source Review Reform Regulations, and potential new guideline models such as AERMOD and CALPUFF.

TABLE 1-1

AIR QUALITY MODELING PROTOCOL CHECKLIST
(Applicants should use this table to check that their protocol includes all appropriate information. Relevant sections from the technical manual are identified in parentheses)

1. AIR QUALITY REGULATIONS APPLICABLE TO THE PROJECT (3.1, 3.2)
   a) federal regulations, PSD
   b) New Jersey regulations including Subchapters 8, 18, 22.

2. PROJECT DESCRIPTION (4.1, 4.2)
   a) source description, size, fuels
   b) location
   c) attainment status
   d) facility plot plan and location of EPA defined ambient air

3. EMISSIONS AND STACK DATA (4.3)
   a) criteria pollutant emissions (lbs/hr and tons/yr)
   b) toxic emissions (lbs/hr and tons/yr)
   c) stack parameters, base elevation, and UTM coordinates
   d) signed VEM-003 & -004 permit forms

4. AUER=S LAND USE ANALYSIS (5.1)
   a) map of land use within 3 km
   b) breakdown of land use types
   c) percent urban and rural

5. TOPOGRAPHY (5.2)
   a) discussion of nearby terrain
   b) location of terrain above stack top

6. GEP STACK HEIGHT ANALYSIS (5.3)
   a) plot plan with building dimensions including height
   b) a table with each structure=s height, projected width, distance from each stack, 5L distance, and formula GEP stack height
   c) identification of each stack=s controlling structure
   d) The stack & building coordinates used in BPIP
   e) need for a building cavity impact analysis (5.4)

7. MODEL SELECTION (6.1)
   a) justification for all models proposed
   b) 5 digit version number

8. METEOROLOGICAL DATA (6.2)
   a) use of appropriate meteorological data in screening analysis (6.2.1)
   b) use of appropriate meteorological data in refined analysis (6.2.2)

9. SCREENING MODELING (6.3)
   a) simple terrain and, if needed, complex terrain
   b) receptor locations
   c) correct model options
   d) averaging times and conversion factors
   e) alternate loads, fuels

10. REFINED MODELING (6.4)
   a) receptors
   b) correct model options and relevant averaging times
   c) impacts compared to Class II and, if applicable, Class I significance levels (6.5)
   d) significant impact radius (6.5)

11. SPECIAL TOPICS (7.0)
   a) Class I area visibility modeling (7.1)
   b) deposition (7.3)
   c) cooling towers (7.4)
   d) coastal fumigation (7.5)
   e) health risk assessment (7.6)
   f) fugitive emissions (7.7)
   g) start-up & shutdown impacts (7.9)
   h) proper use of running and blocked averages (7.10)
   i) odor modeling (Appendix G)

12. BACKGROUND AIR QUALITY (8.0)
   a) background monitoring data (8.1)
   b) nearby major sources modeling analysis (8.2)
   c) pre- or post-construction monitoring (8.3)

13. MODELING RESULTS (9.1 and 9.2)
   a) compliance with NAAQS, NJAAQS, and PSD Class II increments
   b) comparison with NJDEP 1-hour NO2 guideline
   c) acceptable Class I area impacts
   d) negligible health risks

14. DOCUMENTATION (9.3)

a) submittal of all protocols and analyses in 3-ringed, loose-leaf binders

b) narrative report with tables and figures

c) model inputs, outputs, meteorological data (diskette)

2.0 SOURCES REQUIRING AN AIR QUALITY MODELING ANALYSIS

2.1 Criteria for Determining that an Air Quality Modeling Analysis is Necessary

The requirements for modeling are addressed in New Jersey Administrative Code (N.J.A.C.) 7:27-8.4 [Applications for preconstruction permits and certificates] and 7:27-22.8 [Air quality simulation modeling and risk assessment for operating permits].

N.J.A.C. 7:27-8.4(f) gives the NJDEP authority to request an air quality impact analysis of any source. This authority is exercised when the NJDEP believes a proposed emissions increase has the potential to violate an ambient air quality standard or exceed a PSD increment, increase ambient air concentrations above significance levels in a nonattainment area, or exceed a criteria established by the NJDEP to protect human health, welfare, or the environment. N.J.A.C. 7:27-8.4(j) specifically states that an air quality impact analysis must be performed for preconstruction permit applications that are subject to PSD air quality requirements or propose an emission increase that subjects them to N.J.A.C. 7:27-18 [Emissions Offset Rule].

N.J.A.C. 7:27-22.8 states that applicants for an initial operating permit for a new major facility, or for a minor modification or significant modification to an existing operating permit, shall conduct air quality modeling in accordance with this technical manual if:

- The application is subject to PSD impact requirements,
- The application is subject to the air quality impact analysis requirements of N.J.A.C. 7:27-18.4,
- The application relocates the facility to a site not specifically authorized in the original permit for which modeling was performed,

- Based on screening procedures published in technical manuals by the Department, the application includes source operations which have the potential of causing adverse air quality effects (i.e., violation of an ambient air quality standard, exceedance of a PSD increment, a significant air quality impact in a nonattainment area, or cause air pollution as defined in P.L. 1954 c.212/N.J.S.A. 26:2C-1 et seq.[1]).

In order to meet these regulatory provisions in both 7:27-8 and 7:27-22, this guideline provides criteria for determining when an air quality impact analysis is required. An impact analysis must be submitted in support of the permit application in the following situations.

1. The permit application is subject to PSD regulations. Details concerning PSD applicability are given in Section 3.1 and Appendix A of this document.

2. All hazardous waste, municipal solid waste, or sludge incinerators, regardless of the size of the incinerator.

3. All medical waste, pathological, industrial, or commercial incinerators, regardless of the size of the incinerator. An exemption from this modeling requirement will be granted to non-PSD applications if the height of the stack is 1.5 times the height of the controlling building [see Section 5.3 Good Engineering Practice (GEP) Stack Height Analysis] and the screening risk assessment shows a cancer risk equal to or less than 1 in a million. A GEP stack height analysis and screening risk assessment must be submitted with the pre-construction permit application if this exemption is being requested.

4. On-site cleanups or off-site commercial treatment of hazardous waste if the screening risk assessment shows a cancer risk of greater than 1 in a million.

[1] AAir Pollution@ as used in this act shall mean the presence in the outdoor atmosphere of one or more air contaminants in such quantities and duration as are, or tend to be injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property throughout the State and in such territories of the State as shall be affected thereby and excludes all aspects of employer-employee relationship as to health and safety hazards.

5. The permit application proposes an increase in its annual emissions that equals or exceeds the limits listed in Table 2-1. All allowable emission increases that have occurred at the facility in the contemporaneous period (a time period running from five years before construction of the new or modified source until its initial operation) should be included. The emission rates in Table 2-1 apply regardless of whether the source is part of a facility defined as "major" in N.J.A.C. 7:27-18.1. In limited situations modeling may not be required if a netting analysis indicates the source's net emission increases will be below the levels in Table 2-1 (see Section 2.2).

Table 2-1 is based on the significant net emission increase levels defined in N.J.A.C. 7:27-18. Because there are currently no accurate methods of modeling point source ozone impacts, volatile organic compound (VOC) emissions are not included in Table 2-1. Except for nitrogen oxides (NOx) [for which the significance level has been reduced in N.J.A.C. 7:27-18 because it is considered a precursor to ozone], the emission rates given in Table 2-1 correspond to the PSD significant emission rates listed in Table A-2 of this document. The screening procedures in Technical Manual 1003 indicate a source with emission levels equal to or greater than those in Table 2-1 has the potential of causing adverse air quality effects. In Table 2-1 the larger NOx PSD significance level of 40 ton per year is specified for taller stacks. The impacts calculated using Technical Manual 1003's screening procedures show that stacks equal to or greater than 58 ft in height with NOx emissions of less than 40 tons per year pose minimal threat to the nitrogen dioxide ambient air standard or Class II PSD increment.
[The increase in stack height was necessary because the maximum annual NO_2 concentration monitored in New Jersey in both 1994 and 1995 was 77 ug/m^3. The 55 ft stack height was based on 1990-92 monitoring data which had a maximum annual NO_2 concentration of 72 ug/m^3.]

6. In addition to the above, the BAQEv may request modeling in other unique circumstances. These circumstances could involve a permit application at an existing major facility that NJDEP believes may be causing or contributing to a violation of an ambient air standard or PSD increment, or posing a threat to public health or welfare. For example, if a proposed increase in the lbs per hour emission rate of a criteria pollutant of sufficient magnitude that, in combination with the source=s stack height, may cause or contribute to a violation of a short-term ambient air standard or PSD increment, modeling may be required.

2.2 Requirements for Modeling When Performing a Netting Analysis

In some cases an applicant may perform a netting analysis when obtaining a pre-construction permit for a new or altered source. By accounting for creditable emission reductions, the net emissions increase at a facility may be reduced below levels of Emissions Offset Rule and PSD applicability. The methodology for calculating the net emissions increase at a facility is described in N.J.A.C. 7:27-18.7 (Determination of a net emission increase or a significant net emission increase) and the *New Source Review Workshop Manual - Draft* (EPA,1990). Note that significant changes in the method of conducting a netting analysis are contained in USEPA=s April 1996 Proposed New Source Review Reform Regulations.

The netting analysis may also reduce the emissions increase at the facility below the tons per year values specified in Section 2.1 for which an air quality impact analysis is required. An exemption from performing a modeling analysis can be requested in such a situation. The request must be accompanied by a demonstration that the source at which the emissions increase occurs will have a higher final plume height than that from which the emissions reduction are being taken. The higher plume height must occur under all atmospheric conditions. If there is uncertainty as to the relative heights of the plumes, EPA's simple screening model PTPLU2 can provide this information under a variety of atmospheric conditions.

The exemption request may be denied by NJDEP. A denial would occur if NJDEP believes that the reduction in ambient air concentrations from the emissions decrease will not be sufficient to prevent the proposed emissions increase from causing or contributing to a violation of an ambient air standard or PSD increment, or posing a threat to public health or welfare. Proposed emission increases from a source located near complex terrain, or near the property boundary line of the facility, or in an area where elevated background air concentrations exist, or a stack subject to building downwash would be examples of a situation where a requested exemption from modeling may be denied.

When modeling a source for which a netting analysis has been provided, an applicant may in most cases include not only the proposed emission increases, but also the creditable emission reductions at the source.

TABLE 2-1

CRITERIA POLLUTANT EMISSION INCREASES
REQUIRING AN AIR QUALITY IMPACT ANALYSIS[a]

Pollutant	Emission Rate (tons per year)
Carbon monoxide	100
Nitrogen oxides	25[b]/40[c]
Sulfur dioxide	40
Total suspended particulates (TSP)	25
Inhalable particulate (PM-10)	15
Lead	0.6

a. Other situations may require an air quality impact analysis, see Section 2.1 for details.

b. Applies if the stack or release height of the source is less than 58 ft.

c. Applies if the stack or release height of the source is equal to or greater than 58 ft.

3.0 REGULATORY REQUIREMENTS

The modeling protocol should discuss what federal and New Jersey air quality modeling regulations apply to the proposed project. Below is a brief summary of the air quality modeling regulations that are most often applicable.

3.1 Federal Regulations

3.1.1 National Ambient Air Quality Standards (NAAQS)

The 1970 Clean Air Act was enacted by Congress to protect the health and welfare of the public from the adverse effects of air pollution. Subsequently, the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: sulfur dioxide (SO_2), inhalable particulates (PM-10), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and lead.

The National Ambient Air Quality Standards (NAAQS) (listed in Table B-1 of Appendix B) include both "primary" and "secondary" standards. The primary standards are intended to protect human health with an adequate margin of safety; whereas, the secondary standards are intended to protect public welfare from any known or anticipated adverse effects associated with the presence of air pollutants, such as damage to vegetation. The more stringent of the primary or secondary standards are applicable to the modeling evaluation. The NAAQS have been developed for various durations of exposure. The short-term (24 hours or less) NAAQS for SO_2 and CO refer to exposure levels not to be exceeded more than once per year. Long-term NAAQS for SO_2, NO_2, lead refer to limits that cannot be exceeded for exposure averaged over three months or longer. Compliance with the PM-10 24-hour and annual standards are statistical, not deterministic. The standards are attained when the expected number of exceedances each year is less than or equal to 1. This means when modeling with 5 years of meteorological data, compliance with the 24-hour standard is demonstrated when the 6th highest 24-hour concentration at each receptor, based on 5 years of modeling, is predicted to be below the standard. Compliance with the annual standard is demonstrated when the 5-year concentration at each receptor is predicted to be below the standard.

Details of the New Jersey Ambient Air Quality Standards (NJAAQS) are given in Section 3.2.1.

3.1.2 Prevention of Significant Deterioration (PSD) Regulations

If an emission increase from the proposed source qualifies as a "major source", or an existing major facility proposes a significant emissions increase (see Table A-2), it is subject to EPA Prevention of Significant Deterioration (PSD) requirements. The five major components of the PSD permitting process are Applicability, Best Available Control Technology (BACT), Air Quality Analysis, Additional Impacts Analysis, and Class I Area Impact Analysis. Further details concerning PSD regulations may be found in the Federal Register (45 FR 52676, August 7, 1980), the Code of Federal Regulations (40 CFR 52.21), the PSD Workshop Manual (EPA, 1980b) and the draft New Source Review Workshop Manual (EPA, 1990). A brief discussion of the Air Quality Impact Assessment required by the PSD process is presented in Appendix A.

Table 3-1 lists the criteria and noncriteria pollutants that are currently regulated under the Clean Air Act and are subject to PSD review and permitting requirements.

3.2 New Jersey Regulations

New or altered equipment and control apparatus for which a preconstruction permit and operating certificate are required must meet the provisions of N.J.A.C. 7:27-8 [Permits and Certificates]. Applicants for an operating permit are required to meet the provisions of N.J.A.C. 7:27-22 [Operating Permits]. As discussed in Section 2, N.J.A.C. 7:27-8.4 and N.J.A.C. 7:27-22.8 stipulate the Department's authority to request modeling and risk assessments. N.J.A.C. 7:27-8.6 provides cause for the Department to deny a preconstruction permit application. If the air quality modeling analysis indicates the following, the preconstruction permit will be denied.

1. An exceedance of any State or Federal ambient air quality standard;

2. An exceedance of any applicable PSD increment as defined in 40 CFR 52; (see Appendix A),

3. A contravention of any other criterion established by the Department to protect human health and welfare and the environment,

4. Violation of any Federal stack height or emission dispersion requirement as stated in 40 CFR 51.

N.J.A.C. 7:27-22.3(cc) provides cause for the Department to deny an operating permit application for initial, minor modification, significant modification, or renewal:

Aif approval of the application would authorize a violation of any applicable requirement, or a contravention of other criteria established by the Department by rule or pursuant to technical manuals published with public input, to protect human health and welfare and the environment, unless the Department simultaneously approves a compliance schedule to achieve compliance.@

If applicable, the air quality modeling analysis must also demonstrate the source is in compliance with the non-attainment area impact requirements contained in N.J.A.C. 7:27-18 (Emission Offset Rule). N.J.A.C. 7:27-18 is briefly summarized in Section 3.2.3.

3.2.1 New Jersey Ambient Air Quality Standards (NJAAQS)

The New Jersey Ambient Air Quality Standards are listed in Table B-2 of Appendix B. New Jersey standards differ somewhat from the national standards in that New Jersey:

$ maintains a 12-month and 24-hour secondary standard for sulfur dioxide (SO_2);

$ maintains 12-month and 24-hour primary and secondary standards for Total Suspended Particulates (TSP);

$ maintains a 1-hour secondary standard for ozone (O_3) which is more stringent than the national standard;

$ has no inhalable particulate (PM-10) standards;

$ regulations specify its 3-hour, 8-hour, and 24-hour standards in terms of moving or running hourly averages, and its 3-month and 12-month (annual) standards in terms of moving or running monthly averages.

Modeling must address compliance with both national and state ambient air quality standards.

3.2.2 Protection of Human Health, Welfare and the Environment

To verify that noncriteria pollutants emitted by a source will not exceed a criterion established by the Department to protect human health or welfare, a health risk assessment is performed. The cancer risk due to carcinogenic emissions are determined using chemical specific unit risk factors. The potential for health impacts from noncarcinogenic emissions are estimated using chemical specific reference concentrations. Details on how to conduct a risk assessment can be found in the Department's Technical Manual 1003 entitled "Guidance on Preparing a Risk Assessment for Air Contaminant Emissions."

Also note that NJDEP uses a 1-hour nitrogen dioxide (NO_2) concentration of 470 µg/m^3 (0.25 ppm) as a guideline in assessing adverse health effects of short term concentrations of NO_2. All sources that emit nitrogen oxides and are required to submit a modeling analysis should address this guideline value.

3.2.3 Non-attainment Regulations

As required by EPA, all areas of New Jersey are classified, for each criteria pollutant, as being in compliance with the NAAQS ("attainment"), or in violation of the NAAQS ("non-attainment), or "unclassified." Those areas that are designated "unclassified" are considered by EPA to be in attainment. A list of the current designated non-attainment areas within the state for each criteria pollutant is presented in Appendix C. Areas in New Jersey may also be identified by the Department as non-attainment based on the results of air quality dispersion modeling analyses or ambient air quality monitoring programs.

The requirements of N.J.A.C. 7:27-18, Control and Prohibition of Air Pollution from New or Altered Sources Affecting Ambient Air Quality (Emission Offset Rule), apply if:

1) a new or existing "major facility" proposes a "significant net emissions increase" of a pollutant for which the area the source is located in is designated non-attainment. The definitions of "major facility" and "significant net emissions increase" as given in N.J.A.C. 7:27-18 are provided in Table 3-2.

2) a new or existing "major facility" proposes a "significant net emissions increase" which when modeled causes an air quality impact equal to or greater than the significant air quality levels (see Table A-3) of a pollutant in an area which is designated non-attainment for that pollutant, or

3) a new or existing "major facility" proposes a "significant net emissions increase" which when modeled causes an air quality impact equal to or greater than the significant air quality levels in an area designated attainment, and this impact when added to background results in a violation of an applicable NAAQS or NJAAQS (see Table A-3).

Item 1 would only apply to sources located within the non-attainment area, while Items 2 and 3 apply to sources outside the non-attainment area.

TABLE 3-1

PSD REGULATED POLLUTANTS

Criteria Pollutants	Noncriteria Pollutants
Carbon Monoxide	Hydrogen Sulfide (H_2S)
Nitrogen Oxides	Reduced Sulfur Compounds (including H_2S)
Sulfur Dioxide	Total Reduced Sulfur Compounds (including H_2S)
Particulate Matter (TSP and PM-10)	CFC's 11, 12, 112, 114, 115
Ozone (Volatile Organic Compounds)	Halons 1211, 1301, 2402
Lead (elemental)	Municipal Waste Combustor (MWC) Acid Gases, Metals, and Organics
Municipal Solid Waste Landfill Nonmethane Organic Compounds	Ozone Depleting Substances (ODS) regulated under Title VI of the CAAA
	Sulfuric Acid Mist
	Fluorides (except hydrogen fluoride)

source: 40 CFR 52.21

TABLE 3-2

7:27-18 EMISSIONS OFFSET RULE DEFINITIONS OF
MAJOR FACILITY AND SIGNIFICANT NET EMISSION INCREASE

Pollutant	Major Facility Threshold Level [a] (tons/year)	Significant Net Emissions Increase [b] (tons/year)
Carbon monoxide	100	100
Nitrogen dioxide	25	25
Volatile organic compounds	25	25
Sulfur dioxide	100	40
Total suspended particulates (TSP)	100	25
Inhalable particulate (PM-10)	100	15
Lead	10	0.6

a. from N.J.A.C. 7:27-18.1

b. from N.J.A.C. 7:27-18.7, Table 3

4.0 PROJECT DESCRIPTION

It is essential that the air quality modeling protocol contain a description of the project, a facility plot plan, and the source data which will be used in the modeling analysis. A discussion of each of these items is presented in this section.

4.1 Project Overview

A description of the proposed source or modification should contain the following essential information:

$ Type of facility (e.g., resource recovery facility, coal-fired power plant, sewage sludge incinerator, etc.)

$ Size of the Facility (e.g., waste input in pounds per hour or tons per day, megawatts, heat input in BTU/hr, etc.)

$ Primary and secondary (if applicable) fuel type

$ Description of the facility equipment

$ Proposed control equipment

$ Allowable hours of operation

$ Map with an appropriate scale indicating the location of the facility

$ Distance to the nearest Class I area (see Appendix D)

$ Attainment status of all criteria pollutants and source location relative to non-attainment areas (see Appendix C)

$ Brief description of the area in the vicinity of the source in terms of land use, major geographic features, residential areas, etc.

4.2 Facility Plot Plan

A preliminary site plot plan must be provided with the modeling protocol. The plot plan must show the facility's property line and the location of all sources and stacks that will be included in the modeling analysis. It should also identify fences and other barriers which would deter public access. EPA defines Aambient air@ as that portion of the atmosphere, external to buildings, to which the general public has access. For the purposes of determining compliance with NAAQS/NJAAQS and PSD increments, a facility=s property is considered Aambient air@ if public access to that property is not precluded by a fence or other physical barrier. Physical barriers such as river banks or swamps must be clearly posted and regularly patrolled so that it is clear the area is not public. The facility plot plan must be of sufficient detail (showing all building dimensions) to enable a complete GEP stack height analysis to be performed. The plot plan should be drawn to a scale, not be reduced, and have an arrow indicating the direction to true North (not plant or magnetic north). A description of the GEP stack height analysis and further details about the facility plot plan are given in Section 5.3. A sample plot plan suitable for submission with a modeling protocol is given in Appendix E.

4.3 Source Data

The emissions and operating design parameters of the source must be specified including annual (tons/year based on operating hours/year) and hourly (maximum allowable pounds/hour) emission rates. The required point source stack parameters (for each fuel type, if applicable) include:

$ stack height
$ stack Universal Transverse Mercator (UTM) coordinates
$ stack base elevation (ft above sea-level)
$ exit diameter
$ exit gas velocity
$ exit gas flow rate
$ exit gas temperature

Area sources include:
$ length and width
$ release height

Volume sources include:

$ initial lateral dimension
$ initial vertical dimension
$ release height (center of volume above ground)

Copies of the signed permit application forms (currently VEM-003 and 004 forms) for the proposed sources should be included in the protocol. The emissions and stack parameters are typically given for 100% load operation. If the source would be expected to operate at other than maximum capacity, then emissions and exit gas characteristics should be given as a function of load for maximum, minimum, and normal operating conditions. If the air quality analysis will include the impact of creditable emissions reductions, all source data relevant to these emissions must also be included in the protocol.

5.0 PROJECT SITE CHARACTERISTICS

The modeling protocol must clearly describe the project site characteristics. This description would include an urban/rural land use analysis, a discussion of the topography in the vicinity of the project, and a Good Engineering Practice (GEP) stack height analysis. Each of these topics are discussed in detail in the following subsections.

5.1 Land Use Analysis

A land use classification procedure should be used to identify whether rural or urban (McElroy-Pooler) dispersion coefficients and wind speed profile exponents are applicable for the source being evaluated. The EPA recommended procedure in the Guideline on Air Quality Models (EPA, 1996) should be followed to help determine urban/rural land use classification. The procedure involves classifying the land use within the area circumscribed by a 3 km radius circle around the source using Auer's land use typing scheme shown in Table 5-1 (Auer, 1978). If the land use types I1, I2, C1, R2, and R3 account for 50 percent or more of the area, then urban dispersion coefficients should be used; otherwise, rural dispersion coefficients should be used. Major roadways and clover leafs should be identified as urban land use areas. Unless the source is located in an area that is distinctly urban or rural, the land use analysis should provide the percentage of each land use type from the Auer scheme and the total percentages for urban versus rural.

The latest available United States Geological Survey (USGS) topographic quadrangle maps in the vicinity of the facility should be used in this analysis. In some circumstances, such as in an area undergoing rapid development, county or local planning board maps may need to be used. A sample land use analysis for a hypothetical source is given in Figure 5-1. The black circle represents a 3 kilometer radius around the proposed plant.

In some situations professional judgement must also be used in classifying a site as urban or rural. For example, Auer's land use analysis may result in a rural designation when a source is located in a heavily urbanized area next to a large body of water. At such a site there are strong arguments that an urban designation is more appropriate. In these and other cases where the urban/rural determination is borderline, consult with NJDEP to determine the mode under which to model the subject source(s).

TABLE 5-1

IDENTIFICATION AND CLASSIFICATION OF LAND USE

Type	Use and Structures	Vegetation
I1	Heavy Industrial: Major chemical, steel and fabrication industries; generally 3-5 story buildings, flat roofs	Grass and tree growth extremely rare; < 5% vegetation
I2	Light-moderate industrial: Rail yards, truck depots, warehouses, industrial parks, minor fabrications; generally 1-3 story buildings, flat roofs	Very limited grass, trees almost total absent; < 5% vegetation
C1	Commercial: Office and apartment buildings, hotels; > 10 story heights, flat roofs	Limited grass and trees; < 15% vegetation
R1	Common residential: Single family dwelling with normal easements; generally one story, pitched roof structures; frequent driveways	Abundant grass lawns and light-moderately wooded; > 70% vegetation
R2	Compact residential: Single, some multiple, family dwelling with close spacing; generally < 2 story, pitched roof structures; garages (via alley), no driveways	Limited lawn sizes and shade trees; < 30% vegetation
R3	Compact residential: Old multi-family dwellings with close (< 2 m) lateral separation; generally 2 story, flat roof structures; garages (via alley) and ash pits, no driveways	Limited lawn sizes, old established shade trees: < 35% vegetation
R4	Estate residential: Expansive family dwelling on multi-acre tracts	Abundant grass lawns and lightly wooded; > 95% vegetation
A1	Metropolitan natural: Major municipal, state, or federal parks, golf courses, cemeteries, campuses, occasional single story structures	Nearly total grass and lightly wooded; > 95% vegetation
A2	Agricultural rural	Local crops (e.g., corn, soybean); > 95% vegetation
A3	Undeveloped: Uncultivated; wasteland	Mostly wild grasses and weeds, lightly wooded; > 90% vegetation
A4	Undeveloped rural	Heavily wooded; > 95% vegetation
A5	Water surfaces Rivers, lakes	

Source: August H., 1978: Correlation of Land Use and Cover with Meteorological Anomalies. *Journal of Applied Meteorology*, 17, 636-643.

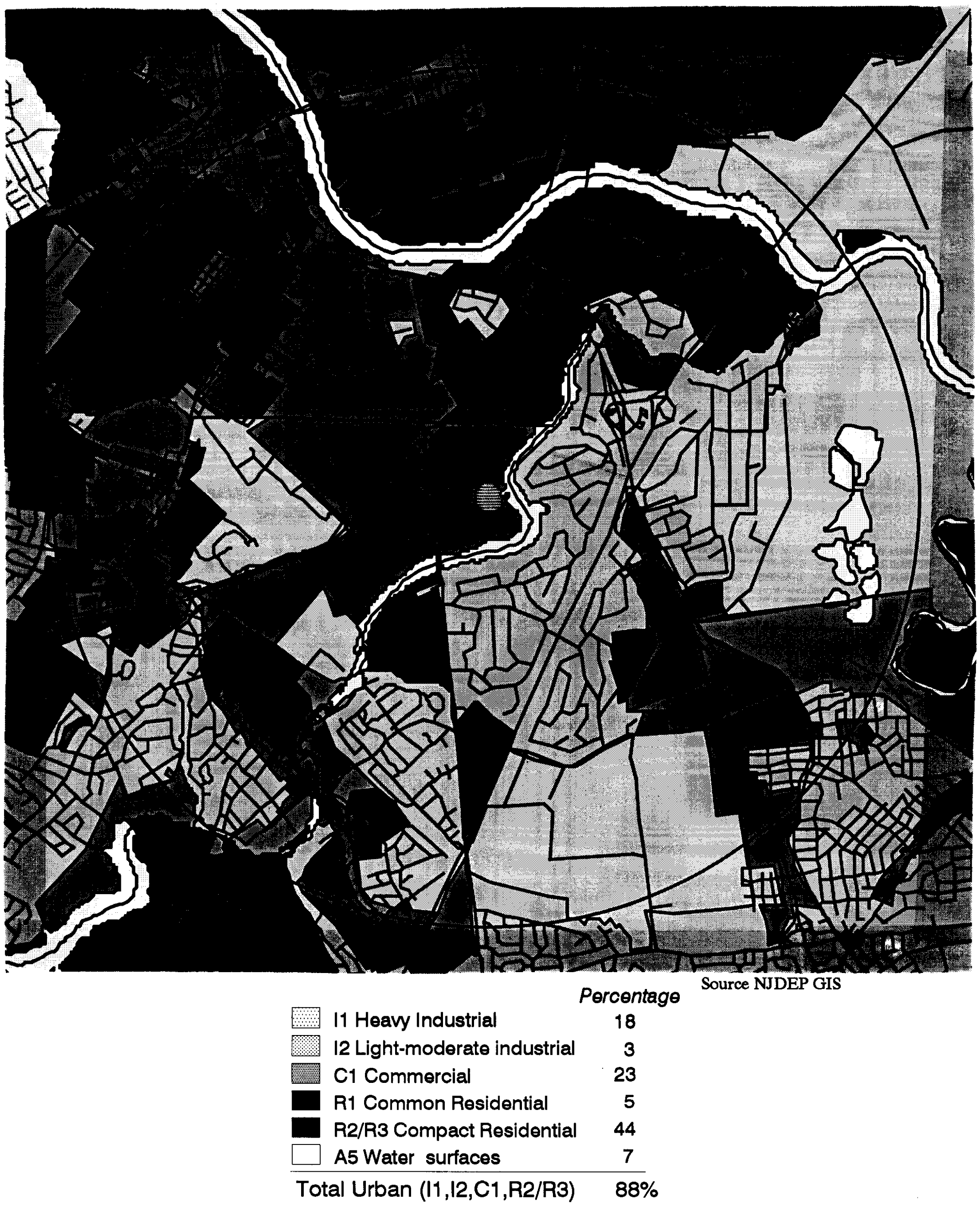

Figure 5-1. Sample land use analysis.

5.2 Topography

In terms of an air modeling analysis, the topography in the region of a source is defined as simple terrain for land features which are below stack top or intermediate/complex terrain for land features above stack top. As is discussed in Section 6.1 and Appendix F, terrain must be considered in the model selection process. USGS topographic maps or Digitized Elevation Model (DEM) data with a 30 meter horizontal scale should be used to evaluate terrain features in the vicinity of the source.

The applicant should include a brief discussion of the topography in the vicinity of the facility. The discussion should include the base elevation of the stack or stacks, the closest terrain point above stack top, and the proximity of hilly terrain. Also, whether the site is coastal or inland, how close the site is to the coast if within 20 kilometers, the closest state border, and whether there are any predominant features (i.e., high-rise structures, man-made hills, lakes, river valleys, etc.) in the vicinity should be discussed.

Generally terrain above stack top should be identified within 10 kilometers of all sources, and within 25 kilometers of PSD sources.

5.3 Good Engineering Practice (GEP) Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis shall be conducted for the modeling protocol in accordance with the EPA stack height regulation (40 CFR 51) and the EPA revised Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (EPA, 1985a). The formula, as defined by the EPA guidelines, for the GEP stack height is:

$$H_{GEP} = H_b + 1.5L$$

where:
H_{GEP} = formula GEP stack height,
H_b = height of adjacent or nearby building,
L = lesser of height or maximum projected width of adjacent or nearby

A stack is considered close enough to a building to be affected by downwash if it is within 5L of the downwind (trailing edge) of the building in any wind direction.

A preliminary site plot plan of the facility should be included with the modeling protocol. The site plot plan must be of sufficient detail (showing all building dimensions) to enable a determination of GEP formula stack height and the potential for building downwash considerations for stack heights less than formula height. The plot plan must include a scale and an arrow indicating the direction to true north (not plant or magnetic north). The grade elevation and height above grade for each structure should be indicated as well as the stack base elevation. In complex cases where there are a number of existing structures or tiers which must be considered in the GEP analysis, photographs or three dimensional sketches are very helpful as additional documentation. A sample site plot plan is included in Appendix E.

The GEP Stack height analysis must identify all buildings on and off site with the potential to cause aerodynamic downwash of emissions from the stack. This analysis need only consider buildings within 0.8 kilometer from the stack. For each stack, a table shall be provided with the following data for each building (or tier):

A) Building height (relative to stack base elevation);
B) Projected building width;
C) Distance from stack;
D) 5L distance; and
E) Calculated formula GEP stack height.

In the table identify the building which gives the greatest formula GEP stack height. In addition to the GEP stack height table, a table with coordinates must be provided for all stacks and each corner of any structure (or structure tiers) that are within 5L of the stacks.

For details on how to enter the necessary building parameters into the Industrial Source Complex (ISC3) model, the only refined model which can currently account for building downwash, refer to the model users guide (EPA, 1995a) under data input requirements. The ISC3 wake effects algorithm requires the input of direction-specific building dimensions. In ISCST3, building height and projected width must be provided every 10 degrees of wind direction. In ISCLT3, this data is needed every 22.5 degrees of wind direction. In a multisource analysis (see Section 8.2), the effects of building downwash on other sources located near the proposed or modified source should be accounted for in the modeling.

As an aid in conducting a GEP stack height analysis, EPA's Building Profile Input Program [BPIP] (EPA, 1993) or an equivalent directional dependent downwash software program may be used. These programs derive the parameters necessary to complete the GEP stack height table described above. Output from these programs must not be used as a substitute for the GEP stack height table. Accurate input to the GEP stack height software programs is vital. The Department will verify the information provided in the GEP stack height table with the facility plot plan. Input/output files from the BPIP program should be submitted to BAQEv on computer disk with the protocol.

The proposed or modified sources may not employ dispersion techniques (as defined in 40 CFR 51.100(hh)) or seek to increase the height of an existing stack unless the provisions in 40 CFR 51.100(kk)2 are met. If the height of the stack is above both the calculated formula GEP height and the de minimis GEP height of 65 meters, the higher of either the calculated GEP height or 65 meters (not the actual stack height) must be used in the modeling to demonstrate compliance with ambient air quality standards. Exceptions are sometimes made for modeling to be used in health risk assessments or in the sitting of ambient monitors. Before modeling a stack height above GEP, the applicant is urged to consult with the Department.

5.4 Modeling the Building Cavity Region

If the height of the source's stack is less than H_{GEP}, there is potential for capture of the plume in the structure's cavity region. The only EPA model currently available for calculating the air quality impacts in the cavity region of the nearby structures is the SCREEN3 model (EPA, 1996) There are two cavity algorithms in SCREEN3, one is the default method which is largely based on results published by Hosker (1984) and the other is the Schulman-Scire cavity algorithm (Schulman and Scire, 1993; Schulman and Scire, 1994). The Schulman-Scire cavity algorithm is identified in the model as the non-regulatory cavity calculation alternative. Review of the two techniques indicates that the Schulman-Scire cavity algorithm in SCREEN3 is the technically superior method. Therefore, the Bureau has adopted the Schulman-Scire cavity algorithm in SCREEN3 as its refined screening technique for calculating short-term building cavity concentrations for non-PSD permit applications. If so desired, the applicant may attempt to make a case that in their situation the default cavity algorithm in SCREEN3 provides a more accurate estimate of the cavity concentration. These requests will be considered by the Bureau on a case-by-case basis.

6.0 PROPOSED AIR QUALITY ANALYSIS

The ambient pollutant concentrations associated with the new or modified source must be assessed through a detailed air quality analysis. This section discusses how the air quality model selection, meteorological data selection, screening and refined modeling, and the significant impact area analysis should be addressed in the modeling protocol.

6.1 Air Quality Model Selection

All modeling is to be conducted with regulatory models identified in EPA's *Guideline on Air Quality Models* (Revised) (EPA, 1996). The models are available from EPA's Source Receptor Analysis Branch, Research Triangle Park, NC. EPA has initiated the Support Center for Regulatory Air Models (SCRAM) with an electronic bulletin board service as the main mode of communication. Interested persons may access SCRAM (http://www.epa.gov/ttn) to download air quality models and user's guides, obtain information on the current status of model development, and obtain model modifications. Additional information on SCRAM may be obtained by calling EPA at (919) 541-5384.

Software and user's guides for individual models are also available through the National Technical Information Service (NTIS) at:

Computer Products
National Technical Information Service
U.S. Department of Commerce
Springfield, VA 22161
(703) 487-4763

Personal computer (PC) versions of the regulatory models that are menu driven are available from the private sector. Persons wishing to obtain PC software or assistance in conducting modeling analyses may obtain the names and addresses of potential vendors or contractors in the directories of air pollution control or meteorological journals.

Several factors must be considered in the model selection process. These factors include source type, pollutant averaging times that are to be addressed, the potential for aerodynamic building downwash affecting the emissions, terrain features and the need for a complex terrain model, and the local urban/rural land use characteristics. Recommendations of EPA's air quality modeling guidelines in regards to model selection are detailed in Appendix F. The modeling protocol should specify the models selected, their version numbers, and a justification for their use in the air quality modeling analysis. The model options used in the analysis must be consistent with those recommended by EPA (1996) and approved by BAQEv.

6.2 Meteorological Data for Dispersion Modeling

Both a screening and refined modeling analysis are usually required for a proposed source. This section describes the meteorological data inputs requirements for each type of analyses. The modeling protocol should describe all meteorological data that will be used in the air quality analysis.

6.2.1 Meteorological Data for Screening Modeling

A screening analysis of a source's impact in simple terrain (terrain below stack top) and intermediate terrain (terrain between stack top and plume height) is done using the meteorological data listed in Table 6-1. The data contained in Table 6-1 are the 54 combinations of wind speed and stability used by EPA's SCREEN3 model (EPA, 1995b) to identify worst-case meteorological conditions. Review of local climatological data indicates winds above 10 m/s rarely occur for prolonged periods in New Jersey. Therefore, load factor screening modeling results obtained for the meteorological condition of D-stability 20 m/s (45 mph) wind speed can be disregarded for non-PSD sources if the applicant obtains BAQEv=s approval. If refined modeling with hourly meteorological data is anticipated, the anemometer height assumed in the screening modeling should match that of the meteorological data used in the refined modeling. The ambient temperature used should either reflect the annual average temperature measured at a representative National Weather Service (NWS) station or the model default (293 deg K).

The screening technique used to determine a source's impact in complex terrain at or above plume height is the VALLEY Screening Technique. The following worst-case meteorological assumptions should be used to calculate 24-hour averages: (1) P-G stability class "F" for rural areas and "E" for urban areas, (2) wind speed of 2.5 m/s, and (3) 6 hours of occurrence. Another screening technique that can be used to determine a source's impact in complex terrain at all locations above stack height is the CTSCREEN model. CTSCREEN uses a combination of 204 screening meteorological conditions (96 stable/neutral and 108 unstable) to estimate impacts.

6.2.2 Meteorological Data for Refined Modeling

For refined modeling analysis, the five most recent available, consecutive years of surface meteorological data combined with concurrent mixing height data from National Weather Service (NWS) upper-air observations should be used. The protocol should provide justification on why the meteorological data selected is representative of the site being modeled. The representiveness of meteorological data is not only a function of proximity, but also other factors such as nearby terrain. An example justification is given in Appendix E. The hourly NWS surface observations include wind direction, wind speed, temperature, cloud cover, and ceiling height. Note that NWS meteorological stations measure wind speed at a height of 20 ft (6.1 meters). The surface temperature data used in the determination of mixing heights should be taken from the same station as the upper air sounding.

TABLE 6-1

STANDARD NEW JERSEY DEP METEOROLOGICAL CONDITIONS FOR SCREENING MODEL ANALYSIS

Stability	Wind Speed (m/s)
A	1.0, 1.5, 2.0, 2.5, 3.0
B	1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
C	1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 8.0 10.0,
D	1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 8.0, 10.0, 15.0, 20.0[a]
E	1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
F	1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0

a. Screening results based on this wind speed can be disregarded with BAQEv=s approval.

Source: EPA, 1995c: *SCREEN3 Model User's Guide.*

STability ARray (STAR) summaries are statistical tabulations of the joint frequency of occurrence of wind speed and wind direction classified according to stability category. Five individual years of the latest available representative STAR data must be used in estimating long-term (monthly, seasonal, or annual) concentrations with long-term models such as ISCLT3. Contact BAQEv for suggested values for temperatures and mixing heights to be used along with annual STAR data in a long term model.

NWS hourly observations, upper air data and STAR decks are available from the SCRAM (http://www.epa.gov/ttn) and National Climatic Data Center in Asheville, North Carolina (704-259-0682). Approval of the selected meteorological surface and upper air sites by the NJDEP should be obtained before purchasing and processing the meteorological data. NWS hourly surface observations and upper air data are currently available from the following locations:

Surface Station - ID No.	Upper Air Station - ID No.
Newark NJ - 14734	Atlantic City NJ - 93755 (up to 8-31-94)
Atlantic City NJ - 93730	Sterling VA/Dulles Airport - 93734
Philadelphia PA - 13739	Albany NY - 14735
Allentown PA - 14737	Brookhaven NY - (after 9-1-94)
Wilmington DE - 13781	

A limited amount of hourly surface data is also available from the Millville NJ airport (Station ID No. 13735).

The National Climatic Data Center expects to release CD updates to their SAMSON data in August of 1997. This update will contain the 1990 through 1995 surface and upper air meteorological data from all first order NWS weather stations. Most missing observations in this database will have been filled in using EPA approved substitution techniques. Sometime after becoming available, BAQEv anticipates that it will be recommending meteorological data sets developed from the SAMSON CD updates for use in refined modeling analysis.

The requirement of five years of meteorological data may be waived when site-specific data are available. A minimum of one year of site-specific data approved by NJDEP is usually required. Guidance on determining the representativeness of off-site data, and on the procedures for collecting on-site data, may be found in *On-Site Meteorological Program Guidance for Regulatory Modeling Applications* (EPA, 1987a). Note that this document was originally issued in 1987 and revised in February 1993, September 1993, and July 1996.

Though considered to be screening models by EPA, results from the complex terrain models COMPLEX-I, SHORTZ/LONGZ, and RTDM are usually considered as part of the refined analysis because of the level of detail required to run these models. The COMPLEX-I, SHORTZ, and RTDM models require the input of hourly meteorological data. As a general rule, meteorological measurements taken on-site must be used in these models. However, NJDEP may allow on a case-by-case basis the use of off-site meteorological data in COMPLEX-I, RTDM, and SHORTZ models. The applicant must demonstrate that the off-site meteorological data are representative of conditions at their project site. Applicants should consult with NJDEP before proceeding with complex terrain modeling beyond the VALLEY screening technique. Additional information on procedures for modeling a source in complex terrain are discussed in Appendix F.

6.3 Screening Modeling Analysis

Screening modeling conducted for the following reasons should be included in the protocol: (1) to provide a preliminary indication of worst-case pollutant concentrations, (2) to identify the source's worst-case load factor scenario, and (3) to assist in delineating the appropriate receptor grid for detailed or refined modeling. By placing these analyses in the protocol, NJDEP can verify their accuracy before the results are used in the refined analysis. Screening modeling conducted to determine a source=s impacts during equipment startup and shutdown (see Section 7.9) or determine the impact of a source located in complex terrain for which no representative hourly meteorological data is available should be submitted in the modeling analysis.

When a source will operate at substantially less than design capacity and changes in the stack parameters associated with the different operating conditions could lead to higher impacts, a screening analysis should establish the load or plant operating condition that causes the highest ground-level concentrations. In addition to modeling 100% design capacity, the alternative operating conditions, such as minimum and average capacity, if applicable, should also be evaluated. The load condition that causes the highest ground-level concentrations should be used when performing the refined modeling analysis (as opposed to the protocol).

In simple and intermediate terrain situations, the ISCST3 model with the meteorological conditions listed in Table 6-1 or the SCREEN3 model can be used to perform screening modeling. When the ISCST3 model with NWS meteorological data will be used in the refined analysis, use of an anemometer height of 6.1 meters is usually preferable for consistency. Screening modeling with ISCST3 is sometimes done in one wind direction. Receptors, beginning at the facility property line if public access is restricted, are placed along a single radial which coincides with the selected wind direction at no more than 100 meter increments. The receptor's terrain elevation should reflect the highest elevation at that distance from the stack in any direction. If the stack will be subject to downwash effects from nearby structures, screening ISCST3 model runs toward the receptor radial should be made using both the maximum and minimum projected building widths. In order to account for changes in terrain elevations when using the SCREEN3 model, use the discrete receptor distance option (not the automated distance option). The 1-hour concentrations determined by ISCST3 or SCREEN3 screening runs may be factored to other short-term averaging times by the following (EPA, 1992a):

Averaging Time	Multiplying Factor
3-hour	0.9
8-hour	0.7
24-hour	0.4
annual	0.1

The above factors apply to a source which is continually emitting for the averaging time of concern (i.e., use of the 1-hour to 24-hour conversion factor of 0.4 assumes the source is emitting for the entire 24-hours). If an applicant believes an alternative 1-hour conversion factor should be used in a specific situation, credible evidence supporting the proposed value should be submitted. NJDEP approval should be obtained before using an alternative multiplying factor to estimate long-term average impacts from 1-hour screening modeling predictions.

In complex terrain above plume height, the VALLEY screening technique is the simplest method for estimating source impacts. The 24-hour concentration determined by the VALLEY screening technique may be converted to estimate other concentrations by the following factors:

Averaging Time	Multiplying Factor
1-hour	4
3-hour	4
8-hour	3
annual	0.4

In urban areas, the VALLEY screening technique should be run with both the rural (F-stability, 2.5 m/s wind speed) and urban (E-stability, 2.5 m/s wind speed) screening meteorology and the highest of the predicted concentrations used. The VALLEY screening technique contained in the VALLEY model, SCREEN3, or COMPLEX-I models may be used to calculate short-term impacts. Use of the Valley screening technique is not allowed in intermediate terrain (complex terrain above stack top but below plume height).

When determining the impact of a source located in complex terrain for which no representative hourly meteorological data is available, it is recommended that the following screening analysis be conducted. For receptors below stack height, estimate 1-hour impacts in 36 directions from the source using ISCST3 and the screening meteorological conditions in Table 6-1. For receptors above stack height, apply the CTSCREEN model with its 204 screening meteorological conditions. Unlike the Valley screening technique, CTSCREEN may be used for all complex terrain receptors, not just those above plume height. The CTSCREEN model has its own factors for converting 1-hour concentrations to longer averaging times. As mentioned earlier, CTSCREEN modeling should be described in the protocol and submitted in the modeling analysis.

The results of the screening modeling analysis including a description of the modeling methodology must be presented to NJDEP. The stack parameters for all load conditions and fuel types ~~to be~~ used in the screening modeling analysis should be listed. If the screening analysis shows that the impacts are considerably less than significant, and NJDEP concurs with the screening modeling methodology and results, it may not be necessary to proceed any further with the modeling analysis. In most cases a refined modeling analysis will be required to determine whether the source causes a significant impact.

6.4 Refined Modeling Analysis

The modeling protocol should clearly describe the methodology that will be used in the refined modeling analysis. In no case should an applicant submit a refined modeling analysis before obtaining NJDEP's approval of a protocol describing the methodology that will be used in the analysis.

The receptor grid used in the refined modeling analysis should be described in detail in the modeling protocol. Receptors must cover the area where the emissions from the source or sources could potentially produce a significant impact. Either a polar coordinate system or a Cartesian grid system may be used for the refined modeling contingent upon the requirements of the air quality model. A polar coordinate grid system usually consists of at least ten concentric ring distances, centered on the stack, and combined with 36 radii at ten-degree intervals (10, 20,...360). Larger impact areas will require additional receptors with the number of receptors increasing proportionally to the size of the area. Spacing between receptors will vary depending on the size of the impact area. The highest terrain elevation in each receptor sector should be used as input to the model. The receptor sector is defined as the area bounded by half the distance between all adjacent receptors. Receptors should also be located along the plant property line. In determining compliance with NAAQS/NJAAQS and PSD increments, a facility=s property is considered Aambient air@ and must have receptors placed on it if public access to that property is not precluded by a fence or other physical barrier. Guidance on locating critical receptor sites may be found in EPA (1996, 1990).

Special attention should be given to areas of highest expected impacts, as determined from the screening modeling analysis, with more compact spacing in these areas. Additional receptors or discrete receptors should be placed at the nearest point with terrain above stack top, ambient air monitoring stations used to establish pollutant background levels, and in areas considered sensitive, such as schools, hospitals, and parks. Tall buildings with balconies or other open-air locations that could be occupied for extended periods must also be considered in the NAAQS/NJAAQS analysis and should be modeled as "flag pole" receptors. Generally, four or five equally spaced receptors from ground-level to roof-top are sufficient for estimating impacts on tall buildings.

Once the refined modeling has been completed using the coarse receptor grid and the receptors with the highest impacts have been determined, a subsequent analysis should be conducted with a fine grid of 50 to 100 receptors spaced at 100 meter intervals or less about the points of highest impact.

The model options to be used in the refined modeling analysis should be specified in the modeling protocol. Typically, the regulatory default option (if available with the applied model) should be used. The regulatory default option automatically selects the EPA recommended options for plume rise, buoyancy induced dispersion, vertical potential temperature gradients, treatment of calms, wind profile exponents, and stack tip downwash. Details on the model options selected for the modeling analysis should be provided.

When modeling annual NO_2 concentrations, the multi-tiered screening approach described in Section 6.2.3 of EPA=s *Guideline on Air Quality Models [Revised]* (EPA, 1996) should be followed. Total conversion of nitrogen oxide (NO) to NO_2 is assumed in Tier 1. In Tier 2, the national default value of 0.75 or a conversion ratio derived using the Ambient Ratio Method (ARM) and local NO/NO_2 monitoring may be used (Chu and Meyer, 1991). Use of the ARM or other conversion factors such as the ozone limiting method for calculating hourly NO_2 concentrations for comparison to the New Jersey guideline value will be considered by BAQEv on a case-by-case basis.

6.5 Significant Impact Area Analysis

EPA (1990) defines the significant impact area (SIA) as a circular area whose radius is equal to the greatest distance from the source modeling shows the proposed emission increase will have a significant impact.

The SIA should be determined for each pollutant and averaging period that has been assigned a significance limit (See Table A-3 in Appendix A). For example, if modeling SO_2, annual, 24-hour, and 3-hour significant impact areas should be determined. The highest modeled pollutant concentration for each averaging time is used to determine whether a source will have a significant impact. The impact area used for the multisource analysis of a particular pollutant is the largest of the impact areas determined for that pollutant. In a refined analysis running average concentrations must be used for short-term averaging periods greater than one hour.

When modeling a facility for which a netting analysis has been performed, the source's proposed emission increases should be modeled first to determine if they will cause a significant impact. No further modeling is required for those pollutants and averaging times for which the proposed emissions increase is predicted to be insignificant. For those pollutants and averaging times that the proposed emissions increase is predicted to have significant impact, additional refined modeling may be conducted which accounts for the effect of the creditable emission reductions at the facility. In this modeling analysis, the proposed emission increases should be modeled as positive emissions and the creditable emission reductions at the facility modeled as negative emissions.

Those major sources that are located within or near the SIA of the proposed facility or modification should be included in a separate multisource modeling analysis. Details concerning how these facilities should be modeled and how to obtain the source information are included in Section 8.2. If refined modeling shows that the proposed source has a significant impact and a multisource modeling analysis is necessary, the applicant must submit a multisource modeling protocol. This protocol would be limited to detailing how the inventory was generated, providing information on the sources included in the inventory, and the modeling methodology that would be employed in the multisource analysis.

The possibility of a significant impact in a class I area must be examined if the source needs a PSD permit and is located within 100 km of a class I area. On a case-by-case basis, PSD sources with large emissions located beyond 100 km may also need to examine their impact on the Class I area. The only Class I area in or within a 100 km of New Jersey is the Brigantine Division of the Edwin B. Forsythe National Wildlife Refuge (see the map in Appendix D). If refined modeling shows that the proposed PSD source has a significant impact in this Class I area, a multisource modeling analysis is necessary to determine PSD increment consumption at the Class I area and possible effects on its Air Quality Related Values (AQRVs). The significant impact levels currently applicable to New Jersey=s Class I area are listed in Table A-4 of Appendix A. Further guidance on conducting a Class I visibility analysis is given in Section 7.1.

7.0 SPECIAL MODELING CONSIDERATIONS

All applicants requiring a PSD permit must prepare an additional impact analysis for each pollutant subject to review. Elements of the additional impact analysis include visibility, soils and vegetation, and growth analyses. Other special modeling considerations that may need to be addressed by both PSD and non-PSD sources include particle deposition, cooling tower modeling, coastal fumigation modeling, modeling for a risk assessment, fugitive emissions, modeling of other nearby major sources, and start-up/shutdown impacts. This section addresses these special requirements and also contains a brief discussion of running and block averages and their relation to NAAQS, NJAAQS, and PSD increments. Include details on how each of these topics will be addressed in the modeling analysis in the protocol.

7.1 Visibility/Class I Area Modeling Requirements

The Workbook for Plume Visual Impact Screening and Analysis (EPA, 1992b) should be used to evaluate the plume visual impact as required by the PSD and visibility regulations of the U.S. EPA. The EPA screening model VISCREEN should be used in a Level 1 or Level 2 visibility analysis. A more detailed, sophisticated plume visibility model such as PLUVUE II is recommended for a Level-3 visibility analysis. Guidance on detailed visibility analyses is also provided by the Interagency Workgroup on Air Quality Modeling (IWAQM). The applicant must demonstrate that the plume meets the visibility criteria discussed by EPA (1992b) at any public scenic overlook or other appropriate location in the impact area. PSD Class I areas, such as the Brigantine Division of the Edwin B. Forsythe National Wildlife Refuge (formerly Brigantine National Wildlife Refuge) in southeastern New Jersey, are afforded special visibility protection designed to prevent plume visual impacts to observers within a Class I area. In addition to a Class I increment analysis, any proposed PSD source or modification within 100 kilometers of a Class I area must evaluate its visibility impact at the Class I area. On a case-by-case basis, NJDEP may also require non-PSD sources within 100 km and PSD sources outside of 100 km of the Class I area to estimate their visibility impact at the Brigantine Class I area.

7.2 Effects on Soils and Vegetation and Growth Analysis

The effects of the proposed source or modification on the soils and vegetation in the impact area must be addressed in a PSD permit application. The application is expected to provide a characterization of the soils and vegetation in the impact area. For all PSD regulated pollutants that will be emitted in significant amounts, an evaluation of any adverse economic and ecological effects of the ambient concentrations projected by the air quality modeling must be submitted. The depth of this analysis will depend on the area=s existing air quality, the quantity of emissions proposed, and the sensitivity of the local soils and vegetation. The applicant is encouraged to consult scientific literature to assess the impacts of applicable pollutants on the soils and vegetation types in the impact area. Further details concerning the soils and vegetation analysis are provided by EPA in the document *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (1980b), the PSD Workshop Manual (1980a) and the draft NSR Workshop Manual (1990).

For PSD permits, any increased residential, commercial, and industrial growth in the impact area that is projected to result from the proposed new source or modification, and the effects of this growth, must be evaluated. The applicant must develop an estimate of the air pollution which would likely evolve from permanent residential, commercial, and industrial growth. Emissions from temporary sources and mobile sources are excluded in this analysis. Further details concerning the growth analysis are provided by EPA (1980a, 1990).

7.3 Particle Deposition (ISC3)

On a case-by-case basis an applicant may propose to include particle deposition when modeling PM-10/TSP impacts or heavy metals in a multi-pathways risk assessment with ISC3. In order to predict wet or dry deposition from a point source using the ISC3 models, a particle size distribution must be developed for the source. This particle size distribution must include the mass fraction, the mean mass particle aerodynamic diameter, and the mean density for each size category. Particle size data can sometimes be obtained from the manufacturer of the proposed particulate control equipment or from EPA=s Compilation of Air Pollutant Emission Factors (AP-42).

The dry deposition algorithms in ISC3 require the input of other additional parameters that are not normally included in an air quality dispersion analysis. These include the surface roughness of the project site and the Monin-Obikov length (ISCST3 only) and friction velocity (ISCST3 only) on an hourly basis. EPA=s meteorological preprocessor (PCRAMMET) is capable of generating a meteorological data set for use in ISCST3 to calculate dry deposition. This preprocessor accepts hourly surface meteorological data either in the National Climatic Data Center CD-144 format, available from the SCRAM bulletin board, or in the SAMSON data format. The following additional data must be provided to PCRAMMET in order to calculate hourly Monin-Obikov length and friction velocity values:

Minimum Monin-Obikov Length
Surface Roughness (surface meteorological station site)
Surface Roughness (project site)
Fraction of Net Radiation Absorbed by Ground
Bowen Ratio
Anthropogenic Heat Flux
Noon Albedo
Atmospheric Pressure (optional)

Suggested values for these parameters can be found in Appendix B of the PCRAMMET User=s Guide available on SCRAM (EPA, 1995c).

Only ISCST3 can calculate wet deposition. In order to calculate the deposition of gases and particles through wet removal, ISCST3 requires scavenging rate coefficients and the amount and type of precipitation for each hour. Applicants who are considering the use of the wet deposition algorithms in ISCST3 should refer to Section 2.1.3 Precipitation Data - TD-3240 Format of the PCRAMMET User=s Guide for additional information.

The particle size distribution, surface roughness values, and inputs into PCRAMMET should be discussed in the protocol and approved by BAQEv before their use in the modeling.

7.4 Cooling Towers

In the permitting of facilities with wet or wet/dry cooling towers, NJDEP requires modeling of the cooling tower plumes to determine their potential for causing fogging and icing of nearby highways. In addition, the cooling towers must be included in the air quality modeling when their particulate emissions exceed 1 lb. per hour. The particulate concentrations due to cooling tower emissions should be added to those caused by other sources at the facility.

7.5 Coastal Fumigation

Fumigation occurs when a plume that was originally emitted into a stable layer is mixed rapidly to ground-level when unstable air below the plume reaches plume level. The well-mixed, unstable air, which develops as air coming from the ocean is heated over land, is known as the thermal internal boundary layer (TIBL). Sources with tall stacks that are located in an area designated as rural and within 3 km of a large body of water must address coastal fumigation in their modeling analysis. Other sources located beyond 3 km may also need to examine their coastal fumigation impacts if NJDEP believes such an analysis is warranted. The recommended screening procedure for estimating ground-level concentrations from coastal fumigation is the SCREEN3 model (EPA, 1995b) If the screening modeling shows potential for large impacts during coastal fumigation, the source should be modeled with the Shoreline Dispersion Model (see *User's Guide to SDM - A Shoreline Dispersion Model* [EPA 1988]).

7.6 Health Risk Assessment

Health risk assessments are required for municipal solid waste incinerators, sewage sludge incinerators, and hazardous waste incinerators, coal-fired power plants, and any other facility that is required to prepare a modeling analysis and emits a toxic substance for which NJDEP has listed an inhalation unit risk factor or a reference concentration. The atmospheric modeling for a health risk assessment should generally follow the guidance outlined in this document.

An air quality impact analysis which includes a health risk assessment should include at a minimum:

1) for each substance included by NJDEP on the unit risk factor list - the maximum predicted long-term average concentration and its location, the applicable unit risk factor, and the calculated incremental cancer risk;

2) for each substance included by NJDEP on the reference concentration list - the maximum predicted long-term (chronic) or short-term (acute) average concentration and its location, the reference concentration, and the calculated hazard index (source impact divided by the reference concentration).

The maximum short-term concentration modeled (not highest, second-high) should be used to calculate the hazard index for compounds with acute health effects. In addition to providing cancer risk and hazard indexes at the point of maximum impact, health risks at the sensitive receptor with the greatest predicted impact may also need to be provided. For health risk assessments, sensitive receptors can include, but are not limited to, residents of occupied homes, hospitals, schools, and parks. Cancer risks and long-term hazard indices need only be predicted at and beyond the applicant=s property-line. If the general public has access to the site, estimates of a short-term hazard index should be made on the facility=s property.

Details on how to prepare a risk assessment protocol and a listing of those substances for which NJDEP has unit risk factors or reference concentrations can be found in the Department's Technical Manual 1003 entitled "Guidance on Preparing a Risk Assessment for Air Contaminant Emissions." As with an air quality analysis, a risk assessment protocol should be approved by NJDEP before an applicant submits the health risk assessment.

7.7 Fugitive Emissions

Fugitive emissions from a facility are those emissions that are not captured and vented through a stack. A proposed source must model the impact of its fugitive emissions unless the release height, emission rate, or distance to the property line is such that minimal air quality impacts would result. A few examples of fugitive emission sources are coal piles, paved and unpaved roads, and gaseous emissions from landfills. Fugitive emissions are usually modeled as area or volume sources. When modeling volume or area sources, the ISC3 model guidance given in the user's guide should be followed (EPA, 1995a). All emission calculations and modeling assumptions should be documented and referenced. Procedures for modeling fugitive emissions should be discussed in detail in the modeling protocol.

7.8 Proximity to Major Sources

In special cases where a proposed source will be located in very close proximity to an existing major source, the NJDEP may require a modeling analysis of emissions from the proposed source along with emissions from the existing source, even if the predicted impacts of the proposed source are insignificant. This type of analysis is usually required in response to, or in anticipation of, concerns on the part of the public and the need to show that the ambient air quality standard will be met in the area surrounding the purposed source.

7.9 Start-up/Shutdown and Equipment Malfunction Conditions

A modeling analysis of the short-term air quality impacts during source start-up/shutdown and equipment malfunction is required when the applicant requests special emission limits during these time periods. NJDEP may also request that start-up/shutdown and malfunction conditions be modeled if it coincides with a low stack exit velocity or temperature. In most cases the start-up/shutdown and malfunction analysis can be accomplished with screening modeling (See Section 6.2.1 and 6.3). The start-up/shutdown and malfunction analysis should be submitted with the modeling analysis, not the protocol. Unless the startup/ shutdown/malfunctions conditions are requested for an extended period or have unusually high emission rates, predicted significant impacts during these scenarios will not require a multisource modeling analysis.

7.10 Use of Running Averages and Block Averages

There are two methods of calculating pollution concentration averages, running averages and block averages. The time when the block average begins and when it ends is specifically defined and never varies. For example, all 24-hour averages are calculated from midnight to midnight, annual averages are calculated from January 1 through December 31, and 3-hour averages are calculated from midnight (12 p.m.) to 3 a.m., 3 a.m. to 6 a.m., etc. Conversely, running averages (sometimes called moving averages) have no set time when they must begin and end. A 24-hour average can begin at 3 a.m. one day and run to 3 a.m. the next day. Running annual averages can occur over any consecutive 12 month period (eg. April 1 through March 31, October 1 through September 30). Determination of maximum impacts at a receptor should be based on non-overlapping running averages.

As mentioned in Section 3.2.1, New Jersey's 3-hour, 8-hour, and 24-hour AAQS are defined in terms of running hourly averages, and its 3-month and 12-month AAQS are defined in terms of running monthly averages. However, all NAAQS, PSD increments, and the AAQS of all States surrounding New Jersey are defined in terms of blocked averages. To help avoid confusion in the execution and presentation of the modeling results, NJDEP recommends the following:

Initially, calculate all short-term impacts in terms of running averages. Quarterly and annual concentrations can be determined as block averages. These values should be used to determine whether the proposed source has a significant impact. However, in a situation where with running averages the proposed source is significant for PM_{10} (24-hour) or at a location where block averages are used to determine compliance (AAQS for a neighboring state, PSD increments in a Class I area), block averages can be used as a final determination of whether the source is significant.

If the New Jersey 3-month lead AAQS is approached or exceeded, rerun the model and calculate the maximum impact using running monthly averages. If a New Jersey 12-month AAQS is approached or exceeded, contact NJDEP for guidance on calculating a running 12-month average.

If a short-term NAAQS, Class I or II PSD increment, or neighboring state AAQS is approached or exceeded, recalculate impacts as block averages for the receptors showing the problem.

8.0 ESTABLISHING BACKGROUND AIR QUALITY

Any source that has a significant impact must address background air quality. Background concentrations are determined by adding representative monitored concentrations to predicted concentrations obtained by modeling nearby major sources. Included in this section is guidance on the selection of background air quality monitoring data and how emission inventory data for the multi-source modeling analysis (if needed) are obtained and applied. Source-specific air quality monitoring requirements are discussed at the end of this section.

8.1 Background Air Quality Monitoring Data

Air monitoring data used in the background determination should be representative of the area of interest (i.e., it should typify the existing concentrations expected at locations of predicted maximum impacts). Possible sources of data are NJDEP's monitoring network, the monitoring network of another local or state agency, or source-specific monitors. Data other than that from NJDEP's air network must be shown to meet NJDEP's air monitoring quality assurance requirements for representativeness, completeness, precision, and accuracy. This subsection discusses what measurements NJDEP collects, how the data should be obtained from NJDEP, and how the monitored ambient air concentrations should be used.

The State of New Jersey's Gaseous Air Monitoring Network in 1995 consisted of 29 automated locations which transmitted data around-the-clock to a centralized computer facility located in Trenton. Pollutants monitored by the Gaseous Air Monitoring Network include: sulfur dioxide, carbon monoxide, ozone, nitrogen oxides, and smoke shade. The meteorological parameters wind speed/direction, temperature, relative humidity, and solar radiation are also measured at three locations (Flemington, Rider University, and Camden Lab). The locations of the gaseous monitors in New Jersey are presented in Figure 8-1. The address, UTM coordinates, and site description for each of the gaseous monitors are listed in Table E-1 of Appendix E.

New Jersey's Particulate Sampling Network in 1995 consisted of 30 locations which collected a 24-hour sample at least once every six days. Samplers are operated for the collection of total suspended particulates at 11 sites and inhalable particulates (PM-10) at 25 sites. Four of the sites also have continuous monitoring instruments for PM-10. Laboratory analyses of particulate samples collected at some of these locations include determinations of concentrations of lead, other trace metals, benzo(a)pyrene, sulfates, nitrates, and extractable particulate organic matter. The locations of the particulate monitors in New Jersey are presented in Figure 8-1. The address, UTM coordinates, and site description for each of the PM-10 monitors are listed in Table E-2 of Appendix E. The address, UTM coordinates, and site description for each of the TSP monitors are listed in Table E-3 of Appendix E.

Unless air quality data collected from a source specific network are used, the latest three years of available monitoring data are to be reviewed. The highest annual and highest, second-highest short-term concentrations from the selected representative monitor should be used as the background concentration for the site. Further refinement of these background air quality values will be considered by NJDEP on a case-by-case basis.

Yearly summaries of air quality data collected by NJDEP are available as Air Quality Reports. Copies of the Air Quality Report can be requested by phone (609-292-0138) or by mail:

NJDEP
PO Box 418
Office of Air Quality Management
Bureau of Air Monitoring
Trenton, New Jersey 08625

The EPA's PSD air monitoring guideline (1987b) recommends that existing monitoring data should be representative of three types of areas: (1) the location(s) of the maximum concentration increase from the proposed source or modification, (2) the location(s) of the maximum air pollutant concentration from existing sources, and (3) the location(s) of the maximum impact area, i.e., where the maximum pollutant concentration would hypothetically occur based on the combined effect of existing sources and the proposed new source or modification. The locations and size of the three types of areas are determined through the application of air quality models. In situations where there are no existing monitoring data in the modeled areas, monitors located outside these three types of areas may possibly be used. Each determination must be made on a case-by-case basis by NJDEP. In some cases site-specific air quality monitoring data may need to be collected (see Section 8.3).

The protocol must specify the monitors selected as representative of background air concentrations, justify their selection, and list the pollutant concentrations that will be used in the analysis if the source is significant. An example of a justification for selected monitoring sites is given in Appendix E. Tables E-1 through E-3 provide information that will assist in determining which monitors are representative of a site. Unless instructed otherwise by NJDEP and regardless of the anticipated significance or insignificance of the source, the applicant must include a discussion of background data in their protocol. This data is often incorporated into the public information package when a draft permit for the proposed source is issued.

8.2 Nearby Source (Multisource) Modeling Analysis

As discussed in Section 6.4, when the impacts from the proposed source or modification are significant, background concentrations are obtained by performing a multisource modeling analysis of nearby major sources and adding representative air monitoring data to the modeling results. For this analysis, a major source is generally considered to be a facility emitting 100 or more tons per year (0.6 tons per year for lead) of the subject pollutant and located within or near the impact area of the proposed source or modification. For applicants requiring a PSD permit, near is considered to extend 50 km beyond the significant impact area. For non-PSD sources, NJDEP usually requires only those sources within and 10 km beyond the significant impact area to be included in the multisource modeling analysis.

The nearby sources that are to be modeled will be identified by NJDEP upon receipt of the following information about the proposed source or modification in the air quality analysis:

1) the UTM coordinates for the proposed source;
2) the pollutant(s) for which impacts are significant; and
3) the size of the impact area(s).

The inventory of the nearby sources in New Jersey will be provided by NJDEP. For proposed sources or modifications with significant impact areas that approach or extend into an adjacent state, a similar type of inventory must be obtained from that state as well. It is the responsibility of the applicant to obtain the necessary data from the other state(s).

A multisource modeling protocol should be submitted and approved by NJDEP before an applicant conducts multisource modeling of nearby sources. The same air quality models and meteorological data used in the modeling of the proposed source should be used for the analysis of nearby sources. In cases where a large number of nearby sources have been identified, the applicant may propose screening techniques to limit the number of sources that are explicitly modeled. The multisource modeling protocol should discuss the screening methodology used to eliminate sources and the results of this analysis. The applicant should obtain NJDEP's agreement on the technique selected to remove sources from the inventory before submittal of the multisource inventory. Receptors of interest are those within the impact area of the proposed source inclusive of:

1) the location of the maximum concentration obtained from the cumulative impacts analysis of the other nearby sources;

2) the location of maximum impact from the proposed source; and

3) the location of the maximum impact of the combined effect of the nearby sources and the proposed source.

8.3 Source-Specific Air Quality Monitoring

The Department may require an applicant to conduct source-specific ambient monitoring for a number of reasons:

1) where the predicted maximum impact of emissions from a proposed facility exceeds the PSD de minimis monitoring concentrations shown in Table 8-1;

2) where there are no existing monitoring sites in the area around the proposed source and data from other sites cannot be shown to be representative of the area;

3) where the emissions from a proposed source may adversely impact an air quality related value (AQRV) in a PSD Class I area, or an area where PSD increments or state and federal air quality standards are threatened; and

4) where there is sufficient public concern over pre- and post-construction ambient levels of criteria and non-criteria pollutants in the vicinity of major proposed facilities and there is little or no existing air monitoring data available.

In the strictest sense, pre-construction monitoring requires the collection of one year of data prior to the Department considering a major source permit application complete for filing. On the practical level, the Department may allow the collection of data during the permit review process such that one year of data is available prior to the proposed approval of the project and the issuance of a draft permit for public comment.

In such a case, existing monitoring data from other sites are used to conservatively represent background concentrations and data from the source-specific monitoring program are used to confirm the air quality impact analysis and provide meaningful data to the public on local air quality levels.

When there is any question as to whether pre-construction air quality monitoring may be required, the applicant should consult with the Department as early as possible so that sufficient time is available to collect an adequate data base.

TABLE 8-1

DE MINIMIS CONCENTRATIONS FOR DETERMINING
PSD AMBIENT MONITORING REQUIREMENTS[a]

Pollutant	Air Quality Concentration ($\mu g/m^3$)	
Carbon monoxide	575	(8-hour)
Nitrogen dioxide	14	(annual)
Sulfur dioxide	13	(24-hour)
Particulate matter - PM-10	10	(24-hour)
Ozone	b	
Lead	0.1	(3-month)
Fluorides	0.25	(24-hour)
Total reduced sulfur	10	(1-hour)
Reduced sulfur compounds	10	(1-hour)
Hydrogen sulfide	0.2	(1-hour)

a Based on the maximum predicted concentration, not the high, second-highest concentration.

b No specific air quality concentration for ozone is prescribed. Exemptions are granted when a source's VOC emissions are less than 100 tons/year.

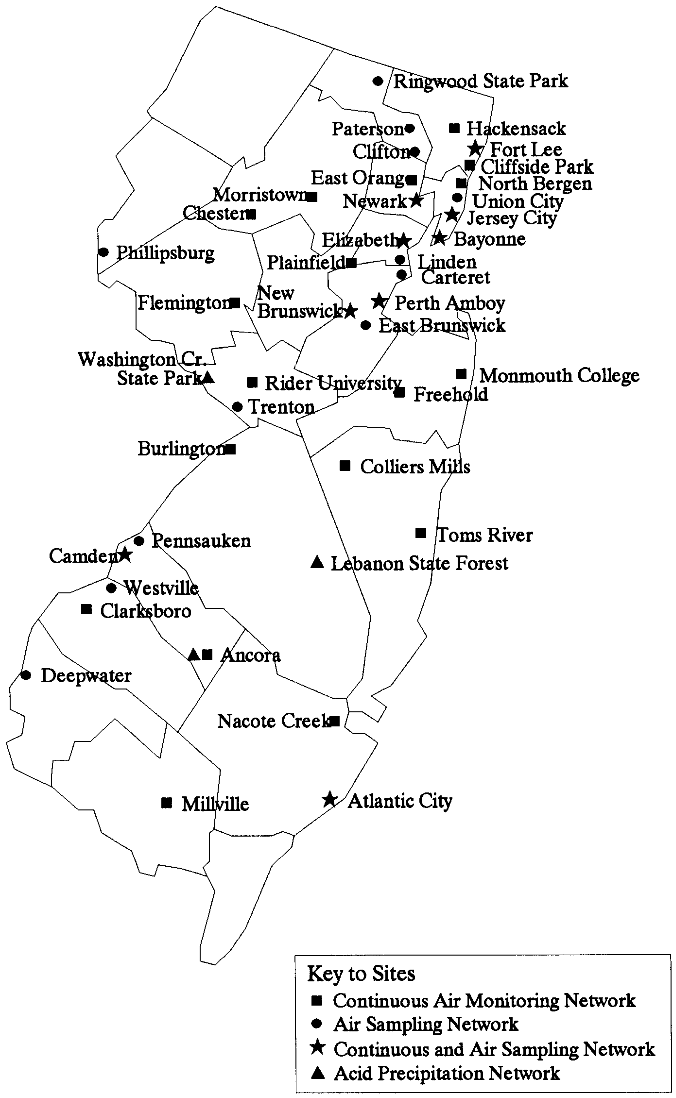

Figure 8-1. The New Jersey Air Monitoring Network

9.0 AIR QUALITY MODELING RESULTS

The results of the air quality dispersion modeling analysis are discussed in this section.

9.1 New Jersey Air Pollution Control Permit Applications

The air quality dispersion modeling analysis must clearly show that emissions of criteria pollutants from the proposed facility will not cause or significantly contribute to a violation of any New Jersey or National Ambient Air Quality Standard. The analysis must contain the following essential information:

1) the emissions and source data input to the modeling analysis;

2) the location and magnitude of maximum predicted impacts for each criteria pollutant (except ozone) for each applicable averaging time;

3) a comparison of maximum predicted impacts to defined significance levels (see Table A-3) for each criteria pollutant (except ozone) for which the proposed source would have emissions;

4) for any proposed source with predicted significant impacts, a comparison of the source's impacts in nonattainment areas to defined significance levels in N.J.A.C. 7:27-18 (Table A-3);

5) for any proposed source with predicted significant impacts, a comparison of maximum predicted impacts, added to background air quality (including the modeled impact of existing major sources), to applicable state and federal air quality standards; and

6) the results of any additional analyses performed following the guidance in Section 7 (Special Modeling Considerations).

The highest long-term average concentrations and the highest second-highest short-term average concentrations may be used to determine compliance with NAAQS, NJAAQS, and PSD increments when five years of off-site or at least one year of on-site meteorological data are used in the modeling analysis. Otherwise, the highest long-term and short-term average concentrations should be used to determine compliance.

The air quality dispersion modeling analysis must also address the Department's 1-hour average nitrogen dioxide guideline concentration of 470 ug/m^3. The highest predicted 1-hour average nitrogen dioxide impacts must be added to representative monitored background concentrations to demonstrate compliance with the guideline. The type of action the applicant may need to take when this guideline value is exceeded will depend on the location, frequency, and magnitude of the exceedances.

9.2 PSD Permit Applications

In addition to the demonstration required in Section 9.1 above, for PSD permits the air quality dispersion modeling analysis must also show that emissions of criteria pollutants from the proposed source will not cause or significantly contribute to a violation of any PSD increment and will not adversely impact any PSD Class I area. The analysis must contain the following additional information:

1) a comparison of maximum predicted impacts to the PSD de minimis monitoring concentrations for each pollutant for which the proposed source is PSD affected;

2) a comparison of maximum predicted impacts to the PSD Class II increments listed in Table A-5 of Appendix A (for a proposed source with predicted significant impacts, the modeled impact of other PSD increment consuming sources must be included);

3) an analysis of the effects of the proposed source on soils and vegetation in the impacted area and a growth analysis;

4) for any PSD source within 100 km from a Class I area and on a case-by-case basis for any PSD source outside of 100 km from a Class I area, a comparison of maximum predicted impacts to the PSD Class I increments listed in Table A-5 of Appendix A (for a proposed source with predicted significant impacts at a Class I area, the modeled impact of other PSD increment consuming sources must be included); and

5) for any PSD source within 100 km from a Class I area and on a case-by-case basis for any PSD source outside of 100 km from a Class I area, a determination if the proposed emissions increase will have an adverse impact on the Class I area=s air quality related values including visibility.

The air quality dispersion modeling analysis must also include any of the noncriteria pollutants subject to PSD review (Table 3-1) which would be emitted in significant amounts. Further details concerning the PSD increment consumption analysis and PSD significant emission rates are given in Appendix A.

The only PSD Class I area in New Jersey is the Brigantine Wilderness in the Brigantine Division of the Edwin B. Forsythe National Wildlife Refuge (formerly the Brigantine National Wildlife Refuge) located in the southern coastal part of the state. A map of the Class I area is included in Appendix D.

9.3 Documentation

The report of the air quality impact analysis should include the input data, a description of the modeling methodology and modeling results, all in sufficient detail to enable NJDEP to determine the validity of the results and the compliance of the proposed action with all air quality standards.

Documentation of the refined model input and output data must be provided on 3.5 inch diskettes. Please do not submit hard copies of refined modeling input/output. A copy of the meteorological data used in the modeling must be included. Meteorological data in the form of a STAR deck has a default ASCII FORTRAN read format of (6F10.0). Other formats such as (7X,6F7.0) can also be specified. The hourly meteorological data used in the refined modeling is usually in an unformatted or binary file generated by EPA's RAMMET preprocessor. The data can also be used in a formatted ASCII code. The default FORTRAN read format for EPA's RAMMET data is (4I2,2F9.0,F6.0, I2,2F7.1). Applicants must provide the type and formatting of meteorological data submitted. When unformatted or binary meteorological data is sent, specify whether the data is from a Lahey or Microsoft compiled version of RAMMET.

The report should provide a clear narrative describing the meaning of the modeling results, should include maps showing the location of the source(s) modeled and the significant impact areas if any, and should include tabular summaries of the model results relative to acceptable air quality levels.

Particular attention should be paid to documentation of the Good Engineering Practice (GEP) stack height analysis and the urban/rural land use analysis, and to the identification of significant terrain features and local sensitive receptors.

NJDEP strongly recommends that modeling protocols and analyses be presented in loose leaf format in a binder so that additions or revisions can be made easily. If this is not done, both minor and major revisions will require resubmittal of the entire document. Applicants are reminded that all impact assessments are public information (except process information marked confidential as defined in N.J.A.C.7-27-1.11) and that major permit applications frequently undergo extra scrutiny during public hearing/comment processes. Acronyms and abbreviations should be defined, tables and figures should be clearly labeled, and excess technical jargon should be avoided.

NJDEP's Bureau of Air Quality Evaluation uses a checklist in assessing the completeness of an air modeling protocol and analysis submittal. A copy of the checklist is presented in this guidance document as Appendix G.

10.0 REFERENCES

Auer, A.H., 1978: Correlation of Land Use and Cover with Meteorological Anomalies. *J. Appl. Meteor.*, 17, 636-643.

Bjorklund, J.R. and F.F. Bowers, 1982: *User's Instructions for the SHORTZ and LONGZ Computer Programs, Volumes I and II.* EPA-903/9-82-004a and b, U.S. Environmental Protection Agency, Region III, Philadelphia, PA.

Chu, S.H. and E.L. Meyer, 1991: Use of Ambient Ratios to Estimate Impact of NOx Sources on Annual NO_2 Concentrations. Proceedings, 84th Annual AWMA Meeting, Vancouver, B.C. June 1991.

EPA, 1977a: *User's Manual for the Single Source (CRSTER) Model*. EPA-450/2-77-013. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1977b: *Valley Model User's Guide*. EPA-450/2-77-018. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1980a: *Prevention of Significant Deterioration Workshop Manual*. U.S. Environmental Protection Agency, Research Triangle Park, NC

EPA, 1980b: *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals*. PB82-189572. Prepared by Argonne Mational Lab for the U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1985a: *Guideline for Determination of Good Engineering Practice Stack Height* (Technical Support Document for the Stack Height Regulations). EPA-450/4-80 023R. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1985b: *User's Guide to CDM - Climatological Dispersion Model*. NTIS PB86-136546.

EPA, 1987a: *On-Site Meteorological Program Guidance for Regulatory Modeling Applications*. EPA-450/4-87-013. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1987b: *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)*. EPA-450/4-87-007. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1988: *User's Guide to SDM - A Shoreline Dispersion Model*. EPA-450/4-88-017. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1989: *Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS)*. EPA-600/8-89-041. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1990: *Draft New Source Review Workshop Manual*. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

EPA, 1992a: *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*. EPA-454/R-92-019. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1992b: *Workbook for Plume Visual Impact Screening and Analysis*. EPA-454/R-92-023. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1993: *Building Profile Input Program (BPIP)*. Office of Air Quality Planning and Standards. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1995a: *Industrial Source Complex (ISC2) Dispersion Model User's Guide. Volumes I, II, III*. EPA-450/B-95-003a-c. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1995b: *SCREEN3 Model User's Guide*. EPA-450/B-95-004. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1995c: PCRAMMET User=s Guide (Draft). U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1996: *Guideline on Air Quality Models (Revised)*. 40 CFR Part 51, Appendix W, U.S. Environmental Protection Agency, Research Triangle Park, NC.

ERT, 1987: *User's Guide to the Rough Terrain Diffusion Model (RTDM)*, Rev. 3.20. ERT Doc. P-D535-5-585. Environmental Research and Technology, Inc., Concord, MA (Docket Reg. No. IV-D-5).

Hosker, R.P., 1984: Flow and Diffusion Near Obstacles. In: Atmosphere and Energy Production. Randerson, D. (ed.) DOE/TIC-27601., U.S. Department of Energy, Washington, D.C.

Holzworth, G.C., 1972: *Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States*. AP-101. U.S. Environmental Protection Agency, Research Triangle Park, NC.

Perry, S.G., D.J. Burns and A.J. Cimorelli, 1990. *User's Guide to CTDMPLUS: Volume 2. The Screening Mode (CTSCREEN)*. EPA-600/8-90-087. U.S. Environmental Protection Agency, Research Triangle Park, NC.

Schulman, L.L. and J.S. Scire, 1980: *Buoyant Line and Point Source (BLP) Dispersion Model User's Guide*. Doc. P-7304B. ERT Inc., Concord, MA (NTIS PB81-164642).

Schulman, L.L. and J.S. Scire, 1993: "Building Downwash Screening Modeling for the Downwind Recirculation Cavity," *JAWMA* 43:1122 (1993).

Schulman, L.L. and J.S. Scire, 1994: *Revision to SCREEN2 Model User's Guide*, Earth Tech, Concord, MA.

Turner, D.B. and J.H. Novak, 1978: *User's Guide for RAM*. EPA-600/8-78-016 (Volumes a and b). U.S. Environmental Protection Agency, Research Triangle Park, NC.

APPENDIX A

PREVENTION OF SIGNIFICANT DETERIORATION INFORMATION

APPENDIX A

PREVENTION OF SIGNIFICANT DETERIORATION INFORMATION

This Appendix provides a brief overview of some of the Prevention of Significant Deterioration (PSD) issues discussed in the text. This is not a complete discussion of the PSD regulations and should not be used as a substitute for the actual regulation. Further details concerning PSD regulations may be found in the Federal Register (45 FR 52676, August 7, 1980) and in the Code of Federal Regulations (40 CFR 52.21). The *PSD Workshop Manual* (EPA, 1980a) and the *Draft New Source Review Workshop Manual* (EPA, 1990) are also recommended as good sources of information regarding PSD.

If the emissions increase proposed at a facility equals or exceeds the major source emission threshold levels, or a major modification occurs at an existing major facility, it is subject to EPA Prevention of Significant Deterioration (PSD) requirements. To be classified as a major PSD source, the emissions source must: (1) be in one of the 28 named source categories listed in 40 CFR 52.21 as a major stationary source (Table A-1) and have controlled emissions exceeding 100 tons per year of any pollutant regulated by EPA under the Clean Air Act subject to PSD review (Table A-2), or (2) not be in one of the 28 listed source categories and have the potential to emit 250 tons per year or more of any EPA-regulated pollutant subject to PSD review.

A major modification subject to PSD review is defined as "any physical change or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under the Act." Modifications that might require PSD review include new, modified, or replacement emissions units. The significant emission rates for each regulated pollutant are listed in Table A-2.

The New Jersey and Federal air regulations establish that, in attainment areas, a demonstration of predicted air quality impacts less than the significance levels is equivalent to a demonstration of compliance with the ambient standards. The NAAQS, NJAAQS, and PSD Class II significant impact levels are presented in Table A-3.

All areas of the United States are classified as Class I, II, or III PSD areas depending upon the level of air pollution that is to be maintained. Class I areas are generally national parks and wilderness areas; Class II areas allow for moderate growth and represent most areas of the country; and Class III are designated as areas which intend to foster extensive industrial development. All of New Jersey is designated as a Class II PSD area with the exception of the Brigantine Wilderness in the Brigantine Division of the Edwin B. Forsythe National Wildlife Refuge (formerly the Brigantine National Wildlife Refuge), which is a Class I PSD area. A map of the wildlife refuge, located in southeastern New Jersey, is given in Appendix D. Any proposed PSD source or modification within 100 kilometers of this Class I area must evaluate its increment consumption at the Class I area. On a case-by-case basis, PSD sources outside of 100 km of the Class I area may also be required to estimate their increment consumption at the Brigantine Class I area. The significant impact levels applicable to New Jersey=s Class I area are listed in Table A-4. These significance levels are identical to values proposed by the USEPA and are therefore subject to change. A PSD project whose proposed emissions increase exceeds the levels in Table A-4 at the Brigantine Class I area must conduct a multisource modeling analysis to determine cumulative increment consumption.

A source=s Class I area analysis must also address the impact of its emissions on the Class I area=s air quality related values (AQRVs). Other than visibility, existing PSD regulations do not specifically define what an AQRV is. However, in the April 1996 Proposed New Source Review Reform Regulations EPA proposes to define AQRV as a scenic, cultural, physical, biological, ecological, or recreational resource which may be affected by a change in air quality as defined by the Federal Land Manager (FLM). Among the Brigantine Class I area=s AQRVs of interest to the FLM are visibility, the impact of nitrogen deposition on water quality, and ozone damage to sensitive vegetation. AQRV significance levels for Brigantine Class I area have not been established by the FLM.

Additional guidance on the requirements for PSD Class I area impact analyses may be obtained from National Park Service technical personnel (303-969-2071) at:

National Park Service - Air
Air Quality Branch
Post Office Box 25287
Denver, Colorado 80225

A proposed PSD project must demonstrate that the PSD increments given in Table A-5 for each PSD Class will not be violated. To demonstrate compliance with PSD increment levels, the area which will be impacted by the project must first be defined and then the amount of increment available in that area must be calculated. In order to calculate the amount of increment available, the PSD baseline date of the area where the proposed project is located must be determined. The following PSD baseline dates have been established in New Jersey:

1. New Jersey Portion of the New York - New Jersey - Connecticut Interstate Air Quality Control Region

Sulfur Dioxide	November 3, 1977	(Exxon)
PM-10	November 15, 1978	(GAF)

2. New Jersey Portion of the Metropolitan Philadelphia Interstate Air Quality Control Region

Sulfur Dioxide	October 6, 1977	(Seaview Petroleum)
PM-10	July 18, 1979	(BF Goodrich)

3. New Jersey Portion of the Northeast Pennsylvania Upper Delaware Valley Interstate Air Quality Control Region

Sulfur Dioxide	November 21, 1980	(Hoffmann LaRoche)
PM-10	September 20, 1978	(Hoffmann LaRoche)

4. New Jersey Intrastate Air Quality Control Region

Sulfur Dioxide	November 17, 1988	(CNG Lakewood)
PM-10	November 17, 1988	(CNG Lakewood)

The PSD baseline date for nitrogen dioxide is February 8, 1988 for all areas of New Jersey. It corresponds to the date on which the increments for nitrogen dioxide were first proposed in the Federal Register. A map of the Air Quality Control Regions in New Jersey is provided in Appendix D.

The following emission changes must be used to calculate available increment:

a) Actual emission increases and decreases at baseline sources (sources in operation when the baseline date was set).

b) Allowable emissions from PSD sources (including secondary and fugitive emissions) which have submitted a PSD application as of 30 days prior to the date of application by the proposed source. If the source is an existing PSD source and has been in operation for more than two years actual emissions may be used.

c) Actual emission increases at minor stationary sources and from general area growth.

d) Changes in emissions due to State Implementation Plan (SIP) revisions.

New Jersey DEP will assist all PSD applicants with their increment analysis by providing air quality monitoring data on file, parameters for existing sources located in the State, and modeling analyses developed in support of SIP revisions. It is the responsibility of the applicant to obtain necessary data from other state(s).

NJDEP currently has no policy which limits the amount of short-term or long-term increment one source can consume. However, to allow for future economic development, permit applicants are discouraged from proposing emission increases that will consume most or all of the available PSD increment in an area.

TABLE A-1
NAMED PSD SOURCE CATEGORIES

1.	Fossil fuel-fired steam electric plants of more than 250 million Btu/hr heat input.
2.	Coal cleaning plants (with thermal dryers)
3.	Kraft pulp mills
4.	Portland cement plants
5.	Primary zinc smelters
6.	Iron and steel mill plants
7.	Primary aluminum ore reduction plants
8.	Primary copper smelters
9.	Municipal incinerators capable of charging more than 250 tons of refuse per day
10.	Hydrofluoric acid plants
11.	Sulfuric acid plants
12.	Nitric acid plants
13.	Petroleum refineries
14.	Lime plants
15.	Phosphate rock processing plants
16.	Coke oven batteries
17.	Sulfur recovery plants
18.	Carbon black plants (furnace process)
19.	Primary lead smelters
20.	Fuel conversion plants
21.	Sintering plants
22.	Secondary metal production plants
23.	Chemical process plants
24.	Fossil fuel boilers (or combinations thereof) totaling more than 250 million Btu/hr heat input
25.	Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels
26.	Taconite ore processing plants
27.	Glass fiber processing plants
28.	Charcoal production plants

Source: EPA, 1980: *Prevention of Significant Deterioration Workshop Manual.* U.S. EPA, Research Triangle Park, NC 27711.

TABLE A-2

PSD SIGNIFICANT EMISSION RATES

Pollutant	Emission Rate (tons/yr)
Carbon Monoxide	100
Nitrogen Oxides	40
Sulfur Dioxide	40
Particulate Matter - TSP	25
Particulate Matter - PM-10	15
Ozone (Volatile Organic Compounds)	40 (of VOC)
Lead	0.6
Fluorides	3
Sulfuric Acid Mist	7
Total Reduced Sulfur Compounds (including H_2S)	10
Municipal Waste Combustor (MWC) Acid Gases (measured as sulfur dioxide and hydrogen chloride)	40
Municipal Waste Combustor (MWC) Metals (measured as particulate matter)	15
Municipal Waste Combustor (MWC) Organics (measured as total tetra- through octa- chlorinated dibenzo-p-dioxins and dibenzofurans)	3.5 x 10-6
Municipal Waste Landfill Emissions (Measured as nonmethane organic compounds)	50
CFC's 11, 12, 112, 114, 115	Any emission rate
Halons 1211, 1301, 2402	Any emission rate
Each PSD Pollutant	Emission rate that causes an air quality impact of 1 $\mu g/m^3$ or greater (24-hour average) in any Class I area located within 10 kilometers of the source.

Source: 40 CFR 52.21 (b)(23).

TABLE A-3
NJAAQS, NAAQS, AND PSD CLASS II INCREMENTS
SIGNIFICANT IMPACT LEVELS FOR AIR QUALITY IMPACT (ug/m^3)

Pollutant	Annual	Quarterly	24-Hour	8-Hour	3-Hour	1-Hour
Sulfur Dioxide (SO_2)	1	-	5	-	25	-
Total Suspended Particulates (TSP)	1	-	5	-	-	-
Inhalable Particulates (PM-10)	1	-	5	-	-	-
Nitrogen Dioxide (NO_2)	1	-	-	-	-	-
Carbon Monoxide (CO)	-	-	-	500	-	2000
Lead (Pb)	-	0.1	-	-	-	-

TABLE A-4
PSD CLASS I INCREMENTS
PROPOSED SIGNIFICANT IMPACT LEVELS (ug/m^3)

Pollutant	Annual	24-Hour	3-Hour
Sulfur Dioxide (SO_2)	0.1	0.2	1.0
Inhalable Particulates (PM-10)	0.2	0.3	-
Nitrogen Dioxide (NO_2)	0.1	-	-

TABLE A-5

ALLOWABLE PSD INCREMENTS ($\mu g/m^3$)

Pollutant	Averaging Time[a]	Class I	Class II	Class III
Sulfur Dioxide (SO_2)	Annual	2	20	40
	24-Hour	5	91	182
	3-Hour	25	512	700
Inhalable Particulate (PM-10)	Annual	4	17	34
	24-Hour	8	30	60
Nitrogen Dioxide (NO_2)	Annual	2.5	25	50

[a] All short-term averages (3-hour and 24-hour) are not to be exceeded more than once a year.

APPENDIX B

NATIONAL AMBIENT AIR QUALITY STANDARDS

NEW JERSEY AMBIENT AIR QUALITY STANDARDS

TABLE B-1

NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period[a]	Primary Standard ($\mu g/m^3$)	Secondary Standard ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	Annual	80	-
	24-Hour	365	-
	3-Hour	-	1,300
Inhalable Particulates (PM-10)	Annual[b]	50	50
	24-Hour[b]	150	150
Nitrogen Dioxide (NO_2)	Annual	100	100
Carbon Monoxide (CO)	8-Hour	10,000	10,000
	1-Hour	40,000	40,000
Ozone (O_3)[c]	1-Hour	235	235
Lead (Pb)	Quarter	1.5	1.5

[a] All short-term (1-hour, 3-hour, 8-hour, and 24-hour) standards except ozone and PM-10 are not to be exceeded more than once per year; quarterly and annual standards are never to be exceeded. Annual averages are arithmetic means.

[b] Standard is attained when the expected number of exceedances is less than or equal to 1. See Section 3.1.1 for more details.

[c] The 1-hour ozone standard should not be exceeded more than an average of one day per year over three years.

TABLE B-2

NEW JERSEY AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period[a]	Primary Standard ($\mu g/m^3$)	Secondary Standard ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	12-Month	80	60
	24-Hour	365	260
	3-Hour	-	1,300
Total Suspended Particulates (TSP)	12-Month	75	60
	24-Hour	260	150
Nitrogen Dioxide (NO_2)	12-Month	100	100
Carbon Monoxide (CO)	8-Hour	10,000	10,000
	1-Hour	40,000	40,000
Ozone (O_3)[b]	1-Hour	235	160
Lead (Pb)	3-Month	1.5	1.5

[a] All short-term (1-hour, 3-hour, 8-hour, and 24-hour) standards except ozone are not to be exceeded more than once per 12 month period; 3-month and 12-month standards are never to be exceeded. All short-term averages are calculated as running or moving averages. The 12-month TSP standards are geometric means.

[b] The 1-hour ozone standard should not be exceeded more than an average of one day per year over three years.

APPENDIX C

NEW JERSEY AIR QUALITY NON-ATTAINMENT AREAS

APPENDIX C

NEW JERSEY AIR QUALITY NON-ATTAINMENT AREAS

Table C-1 lists the New Jersey air quality non-attainment areas as of May 1997. Figures C-1 to C-4 show the non-attainment areas within the state. The Federal Register is the primary source for notice of proposed changes in air quality attainment status.

TABLE C-1

NEW JERSEY AIR QUALITY NON-ATTAINMENT AREAS
AS OF MAY 1997

Sulfur Dioxide[1]

Warren County:
- The Town of Belvidere
- The Township of Harmony
- Portion of Liberty Township (South of UTM coordinate N4522 and West of coordinate E505)
- Portion of Mansfield Township (West of coordinate E505)
- The Township of Oxford
- The Township of White

Carbon Monoxide[2]

Bergen County
Essex County
Hudson County
Union County

Passaic County:
- The City of Clifton
- The City of Paterson
- The City of Passaic

Nitrogen Dioxide[3]

No areas in the State are designated as non-attainment.

Lead

No areas in the State are designated as non-attainment.

TSP[4]

No areas in the State are designated as non-attainment.

PM-10[4]

No areas in the State are designated as non-attainment.

Ozone[3]

The entire State of New Jersey

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[1] 52 FR 49408-49411
53 FR 8182

[2] 61 FR 33678-33680

[3] 40 CFR 81.33156

[4] 61 FR 2939-2941

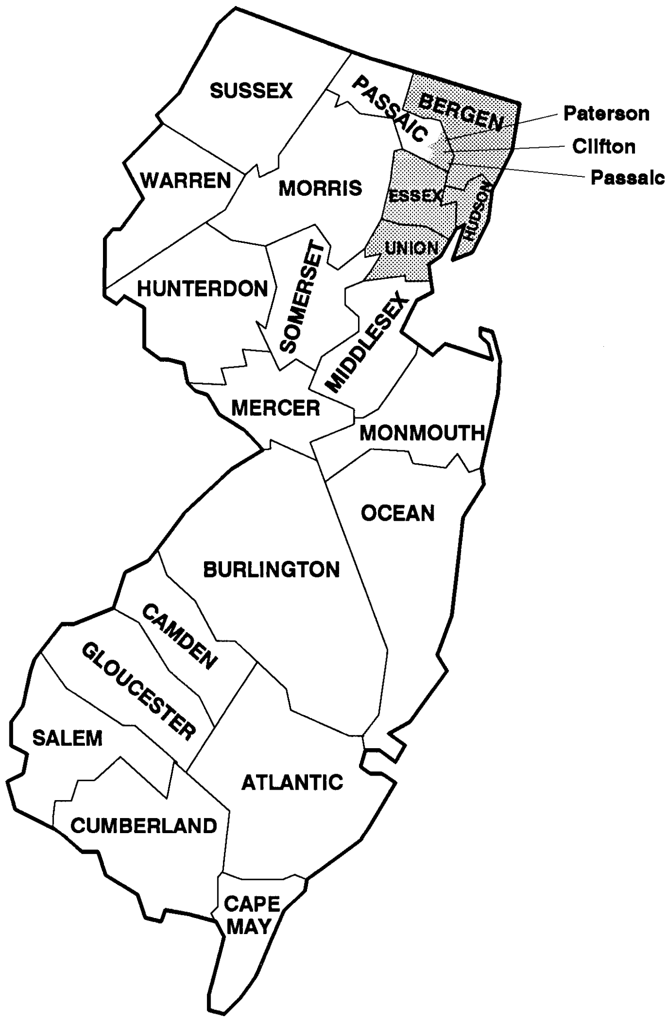

Figure C-1. Non-attainment areas for carbon monoxide in New Jersey.

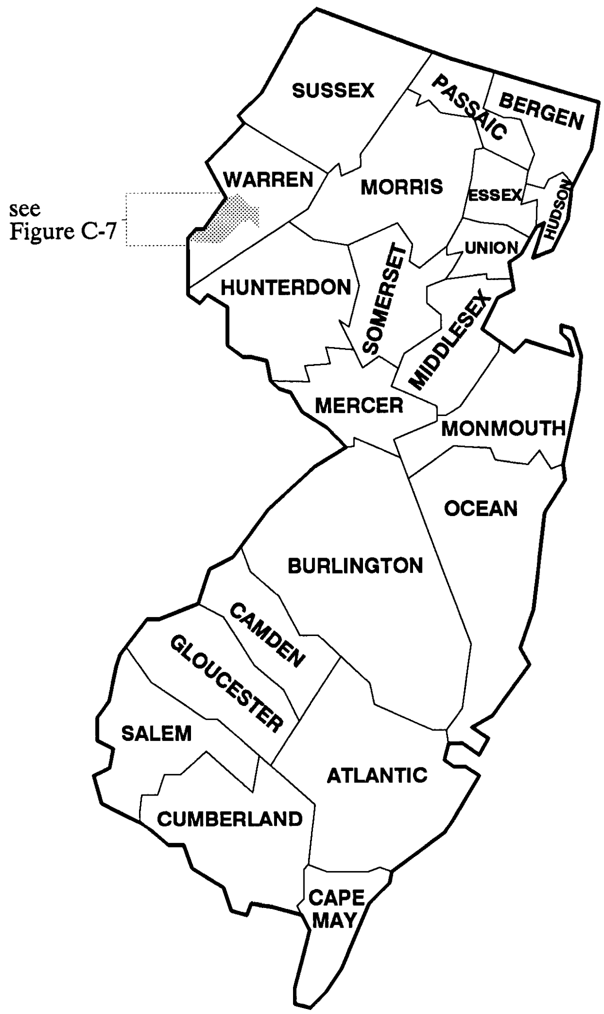

Figure C-2. Non-attainment areas for sulfur dioxide in New Jersey.

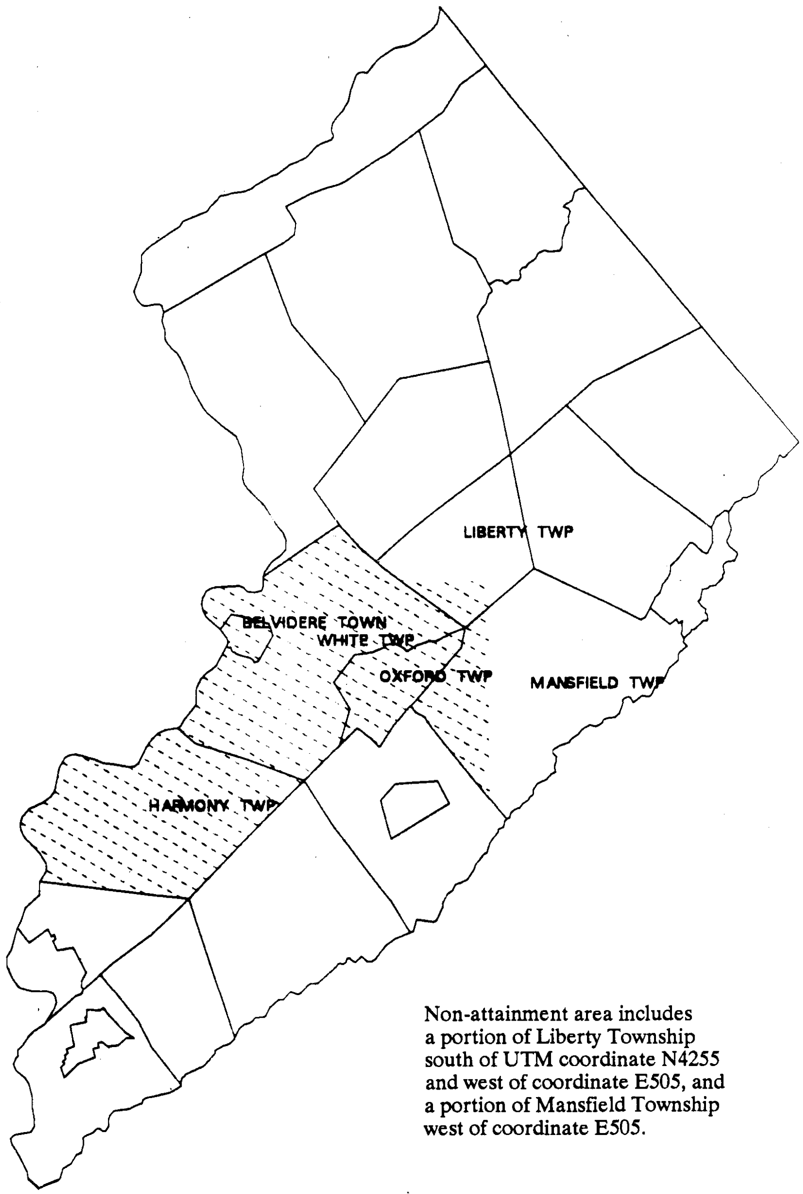

Figure C-3. Non-attainment areas for sulfur dioxide in Warren County, New Jersey.

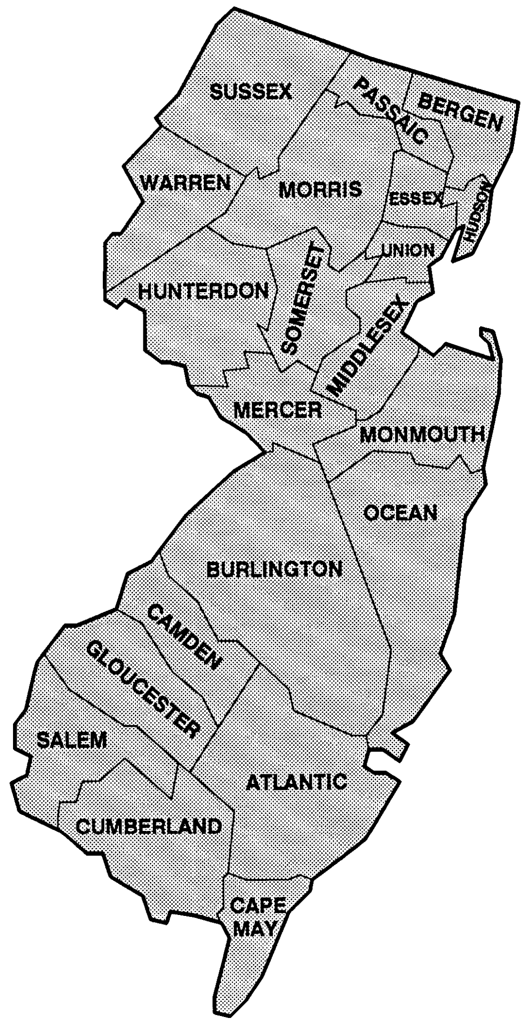

Figure C-4. Non-attainment areas for ozone in New Jersey.

APPENDIX D

NEW JERSEY PSD CLASS I AREA MAP

NEW JERSEY AIR QUALITY CONTROL REGIONS MAP

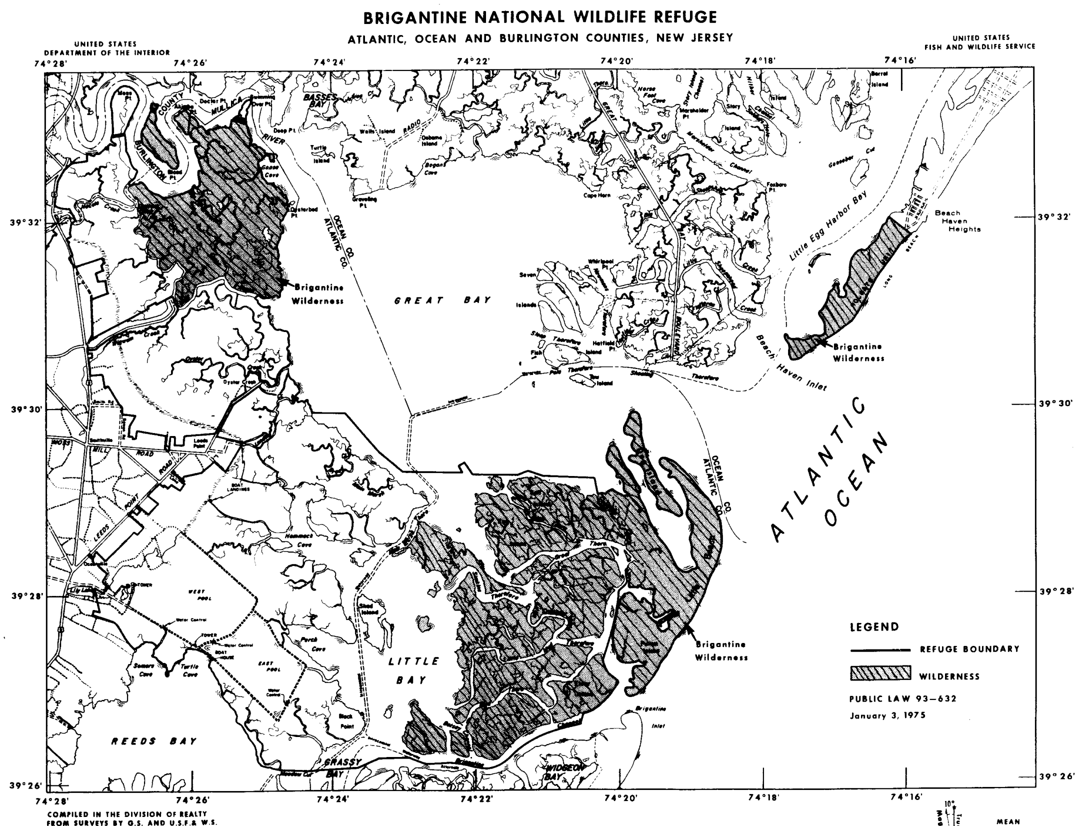

Figure D-1. Location of the Brigantine Division of the Edwin B. Forsythe National Wildlife Refuge (formerly the Brigantine National Wildlife Refuge).

D-2

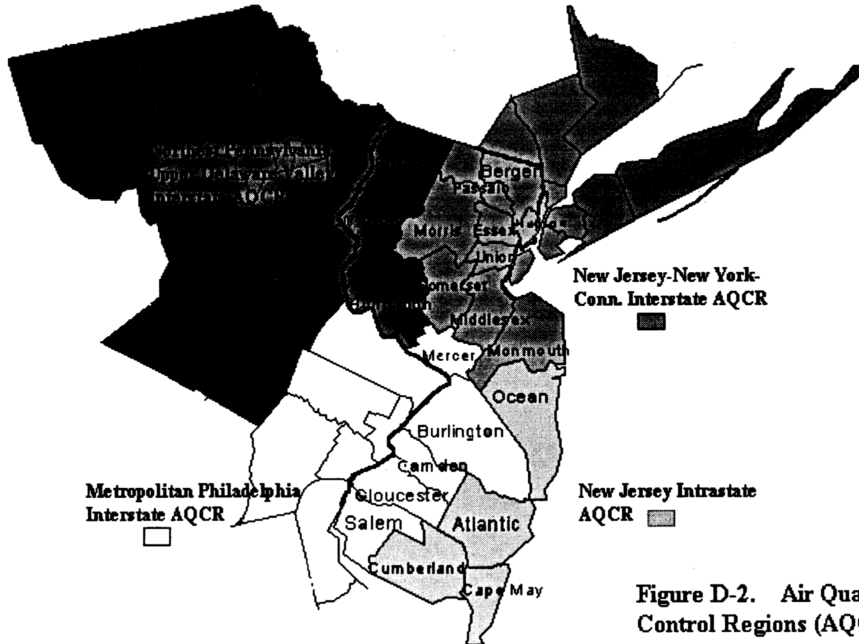

Figure D-2. Air Quality Control Regions (AQCR)
New Jersey and Adjacent Areas

APPENDIX E

SAMPLES OF A PLOT PLAN AND JUSTIFICATION OF METEOROLOGICAL/AIR QUALITY MONITORING DATA, NJDEP MONITORING SITE INFORMATION

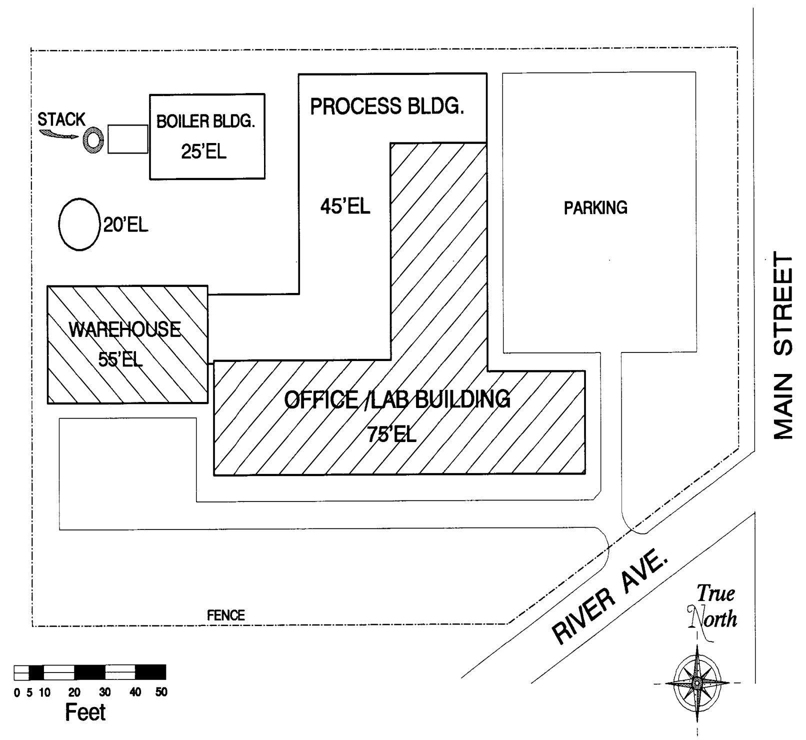

Figure E-1. Sample plot plan.

E.1 Sample of Meteorological Data Justification

The facility, located in Perth Amboy, proposes to use the latest available five years of hourly meteorological data from Newark (surface data) and Atlantic City (upper air data) Airports in the ISCST3 model. The Newark/Atlantic City meteorological data set should be considered representative of the Perth Amboy site for the following reasons. Newark Airport is only 15 miles north-northeast from Perth Amboy. Both sites are located within eight miles of the New Jersey coast in urban settings. In addition, both Newark Airport and Perth Amboy are surounded by relatively flat terrain and are approximately 20 feet above mean sea level. These factors should result in similar wind patterns, atmospheric stability, and surface temperature at the two sites. Upper air data measured at Atlantic City Airport (72 miles to the south) should be representative of the Perth Amboy site since mixing heights tend to be a synoptic phenomena and both are located in similar coastal regions.

E.2 Air Quality Monitoring Data Justification

CARBON MONOXIDE: The facility, located in Edison, proposes to use measurements taken at the NJDEP Perth Amboy carbon monoxide air quality monitoring site as representative background air quality. Carbon monoxide concentrations measured at the NJDEP Perth Amboy monitor should be representative to the Edison site due to their similar urban locations and their proximity to major highways (mobile sources are the main source of carbon monoxide emissions). In addition, Edison is located only five miles west of the NJDEP Perth Amboy carbon monoxide monitoring site.

NITROGEN DIOXIDE: The facility, located in Mays Landing, proposes to use measurements taken at the NJDEP Millville nitrogen dioxide air quality monitoring site as representative background air quality. Nitrogen dioxide is a pollutant which predominately is emitted from mobile sources and large combustion sources. Both Mays Landing and Millville are located in predominately rural areas where there are few large industrial sources or heavy vehicle traffic. In addition, Mays Landing and Millville are only twelve miles from each other.

SULFUR DIOXIDE: The facility, located in Palmyra, proposes to use measurements taken at the NJDEP Camden Lab sulfur dioxide air quality monitoring site as representative background air quality. Emissions of sulfur dioxide are predominately due to industrial combustion sources. Palmyra is located only seven miles northeast of the NJDEP Camden air quality site. Both are across the Delaware River from Philadelphia and are not only influenced by similar industrial combustion sources nearby, but are both downwind of sulfur dioxide emissions from industrial sources in the Philadelphia area.

TABLE E-1
NJDEP GASEOUS AIR MONITORING STATIONS
1995

MONITOR	LOCATION	COORDINATES U.T.M. KILOMETERS	SITE DESCRIPTION
Atlantic City	2100 Pacific Ave Atlantic County	548.5E 4356.3N	Center City - Commercial. Topography-Smooth. Located on the ground floor of the Caesars Hotel and Casino.
Ancora S.H.	Ancora State Hospital, Winslow Township Camden County	511.8E 4392.5N	Rural-residential. Topography-Smooth. Located outside the psychiatric center on Oak Rd.
Bayonne	Veterans Park on Newark Bay Hudson County	573.8E 4502.3N	Urban-Residential. Topography-Smooth. Located off Newark Bay.
Burlington	1 East Broad Street Burlington County	512.1E 4436.2N	Urban-Commercial. Topography-Smooth. Located 1/2 mile from a PSE&G generating station.
Camden Lab	Copewood & Davis Streets Camden County	491.6E 4419.0N	Suburban-Residential. Topography-Smooth. Located behind the Institute for Medical Research.
Chester	Building #1 - Bell Labs Off Rt. 513 Morris County	527.3E 4515.0N	Rural-Agricultural, Residential. Topography-Smooth. Located near Bell Laboratory Building #1.
Clarksboro	Clarksboro Shady Lane Rest Home, County House Rd. Gloucester County	481.7E 4405.4N	Suburban-Residential. Topography-Smooth. Located in a rural area, 17 miles from Wilmington, Delaware.
Cliffside Park	Accomando Place & Cedar Street Bergen County	584.8E 4517.5N	Urban-Residential, Industrial. Topography-Rolling. Located 200 Feet from Palisade Avenue, and 1/4 mile from Hudson River Generating Station.
Colliers Mills	Colliers Mills Wildlife Management Area Ocean County	547.3E 4434.9N	Rural-Wetlands. Topography-Smooth. Adjacent to Turmill Pond.
East Orange	Main Street & Greenwood Avenue Essex County	567.2E 4511.8N	Urban-Residential, Commercial. Topography-Rolling. Located at the No. 2 Engine Company.
Elizabeth	7 Broad Street Union County	566.3E 4501.2N	Urban-Commercial, Residential. Topography-Rolling. Located above a restaurant on a commercial street.
Elizabeth Lab	New Jersey Turnpike Interchange 13 Union County	567.0E 4499.0N	Urban-Industrial. Topography-Smooth. Located 75 yards away from the Toll Plaza.
Flemington	Raritan Twp. Sewage Treatment Plant, Rt. 613S & access road Hunterdon County	516.3E 4484.8N	Rural-Residential, Agricultural. Topography-Rolling. Located near Three Bridges.
Fort Lee	Lemoine Ave., Rt. 67 at the bridge overpass Bergen County	587.0E 4522.9N	Center City-Mobile. Topography-Smooth. Located on an overpass sidewalk parallel to the George Washington Bridge toll plaza.

TABLE E-1 (continued)

MONITOR	COORDINATES U.T.M. LOCATION	KILOMETERS	SITE DESCRIPTION
Freehold	5 West Main Street Monmouth County	561.7E 4456.6N	Center City-Commercial, Residential. Topography-Rolling. Located in the 2nd floor room.
Hackensack	133 River Street Bergen County	580.0E 4526.0N	Urban-Commercial, Residential, Industrial. Topography-Rolling. Located near Moore & Mercer Streets.
Jersey City	2828 Kennedy Blvd. Hudson County	578.7E 4509.0N	Urban-Commercial, Residential, Industrial. Topography-Smooth. Located in the Journal Square section.
Millville	Lincoln Avenue & Highway 55 Cumberland County	497.8E 4363.4N	Rural-Industrial. Topography-Smooth. Located northeast of Millville City.
Monmouth Univ.	Edison Science Bldg. Monmouth University Monmouth County	584.6E 4458.9N	Suburban-Residential. Topography-Smooth. Located in Room E-128. Campus is in West Long Branch.
Morristown	11 Washington Street Morris County	543.6E 4516.2N	Urban-Commercial, Residential. Topography-Rough. Located off Rt. 24.
Nacote Creek R.S.	Brigantine National Wildlife Refuge Atlantic County	546.4E 4375.0N	Rural-Wetlands. Topography-Smooth. Located off Rt. 9 in the National Wildlife Refuge.
New Brunswick	Ryders Lane & Log Cabin Road Middlesex County	548.9E 4480.2N	Urban-Agricultural, Residential. Topography-Smooth. Located at Rutgers University, Horticultural Farm.
Newark Lab	St. Charles & Berlin Streets Essex County	572.3E 4508.5N	Urban-Industrial, Residential. Topography-Smooth. Located between Kossuth & Berlin Sts.
North Bergen	3401 Tonnelle Ave. Hudson County	581.1E 4514.5N	Urban-Commercial, Residential, Industrial. Topography-Rolling. Located in a building near the intersection of Tonnelle Ave. & Paterson Plank Road.
Perth Amboy	130 Smith Street Middlesex County	562.0E 4484.3N	Urban-Residential, Industrial. Topography-Smooth. Located on the 2nd floor of the DEE & DEE store.
Plainfield	40 Rock Avenue Union County	546.1E 4494.0N	Urban-Residential. Topography-Rough. Located in the parking lot of PSE&G's Plainfield Headquarters.
Rider University	Route 206 South Lawrence Township Mercer County	521.9E 4459.1N	Suburban-Residential. Topography-Smooth. Located 600 feet from Rt. 295 on the college campus. A Type 3 PAMS site.
Rutgers Univ.	Horticultural Farm #3 Cook College Middlesex County	548.3E 4479.1N	Suburban-Residential. Topography-Rolling. Located behind the greenhouses of the Vegetable Research Center. A Type 1 PAMS site.
Toms River	201 Main Street Ocean County	568.5E 4422.7N	Suburban-Commercial. Topography-Smooth. Located near Main and Washington Sts.

TABLE E-2
NJDEP PM_{10} SAMPLING STATIONS
1995

MONITOR NJ SITE #	LOCATION	COORDINATES U.T.M. KILOMETERS	SITE DESCRIPTION
Elizabeth (IP1)	600 North Broad Street Union County	566.4E 4502.6N	Center City - Residential, 27' above ground. Located on the Mitchell Bldg.
Camden Lab (IP2)	Copewood and Davis Sts. Camden County	491.6E 4419.0N	Suburban - Residential. Located at the Institute for Medical Research. Part of the Air Toxics Network.
Ringwood State Park (IP5)	Skylands Manor Passaic County	563.9E 4552.2N	Rural - Background. Located at the park near the greenhouse. Part of Air Toxics Network.
Trenton (IP6)	120 Academy Street Mercer County	520.1E 4452.2N	Center City - Residential. Located on the roof of the Trenton Public Library.
Atlantic City (IP7)	Missouri & Baltic Aves. Atlantic County	548.2E 4356.8N	Center City - Commercial. Located in the bus terminal parking lot. Part of the Air Toxics Network.
Jersey City (P8,IP9,IP17)	355 Newark Avenue Hudson County	580.0E 4508.5N	Center City - Commercial. Three samplers operating at the same site in order to achieve an every other day sampling schedule. Located on the roof of the Consolidated Fire House.
Pennsauken (P10 & IP11)	River Road & Griffith-Morgan Lane Camden County	495.7E 4426.3N	Suburban - Residential. Located at the Morris-Delair Water Treatment Plant. Collocated for precision.
Jersey City (P12 & IP22)	555 Duncan Avenue Hudson County	576.5E 4509.3N	Center City - Industrial. Located on the roof of the Hudson Co. Safety & Health Bldg. Collocated for precision.
Clifton (P13)	340 Kingsland (Rt. 3) Passaic County	570.7E 4521.0N	Suburban - Mobile. Located in the Hoffman-LaRoche parking lot, east of Bloomfield Avenue. Analyzed for metals.
Fort Lee (P14)	Lemoine Avenue, Rt. 67 at the bridge overpass Bergen County	587.0E 4522.9N	Center City - Mobile. Topography-Smooth. Located on an overpass sidewalk perpendicular to the George Washington Bridge toll plaza. Part of the Air Toxics Network.
Fort Lee (P15)	320 Main Street Bergen County	586.6E 4522.7N	Center City - Residential. Located on the roof of the Public Library.
Linden (IP18)	5001 South Wood Ave. Union County	566.0E 4495.4N	Suburban - Industrial, 20' above ground. Located at the Linden-Roselle Sewage Authority site.
Carteret (IP20)	230 Roosevelt Avenue Middlesex County	566.2E 4491.7N	Suburban - Industrial, 14' above ground. Located on the roof of the Carteret Police Department building.

TABLE E-2 (continued)

MONITOR NJ SITE #	LOCATION	COORDINATES U.T.M. KILOMETERS	SITE DESCRIPTION
Bayonne (IP21)	28th St. & Ave. C Hudson County	574.6E 4502.1N	Center City - Commercial, 34' above ground. Located on the roof of the Bayonne Municipal Building.
Perth Amboy (IP23)	Sadowski Pkwy & 2nd St. Middlesex County	561.3E 4483.6N	Center City - Industrial, 33' above ground. Located at the Sewage Treatment Plant.
Union City (IP24)	714 31st Street Hudson County	581.7E 4513.7N	Center City - residential, 27' above ground. Located on the roof of the Health Department Building.
East Brunswick (IP26)	Exit 9 of NJTP Middlesex County	550.1E 4480.5N	Suburban - Commercial, Residential. Located on the roof of the NJ Turnpike Authority Building.
Westville (IP27)	High & Duncan Sts. Gloucester County	489.2E 4412.7N	Suburban - Residential. Located on the roof of the Parkview Elementary School.
Elizabeth Lab (IP28)	Exit 13 of NJTP Union County	567.0E 4499.0N	Urban-Industrial. Located in a parking lot 75 yards away from the Toll plaza.
Newark Lab (IP29)	St. Charles & Berlin Sts. Essex County	572.3E 4508.5N	Urban-Industrial, Residential. Located at the edge of an abandoned athletic field between Kossuth & Berlin Sts.
Phillipsburg (IP30)	Meyner Rd., Walters Park Warren County	485.6E 4503.7N	Urban-Residential, Industrial. Located on the roof of the pool house.
Newark (IP31)	Broad and Market Sts. Essex County	569.7E 4509.4N	Center City - Commercial. Located on the roof of the police booth at the southeast corner of Broad and Market Streets. Microscale.
Camden Rutgers (IP32)	4th and Penn Sts. Camden County	489.6E 4421.8N	Center City - Residential, 30' above ground. Located on the roof of the Rutgers University Library.
Camden RRF (IP33 & IP34)	Morgan Blvd. & I-676 Camden County	490.1E 4417.8N	Urban-Industrial. Located in the parking lot of the Camden Resource Recovery Facility offices near the entrance ramp of I-676.

North Bergen (IP35)	3401 Tonnelle Ave. Hudson County	581.1E 4514.5N	Urban-Commercial, Residential, Industrial. Topography-Rolling. Located next to a building near the intersection of Tonnelle Ave. & Paterson Plank Road. Microscale

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TABLE E-3
NJDEP HIGH VOLUME TSP SAMPLING STATIONS
1995

MONITOR NJ SITE #	LOCATION	COORDINATES U.T.M. KILOMETERS	SITE DESCRIPTION
Jersey City (014)	355 Newark Avenue Hudson County	580.0E 4508.5N	Center City - Commercial, 34' above ground. Located on the roof of the Consolidated Fire House. Filters analyzed for metals.
Jersey City (042)	Erie & Bay Streets Hudson County	580.6E 4508.0N	Center City - Residential, 46' above ground. Located on the roof of the Police Station.
Clifton (051)	340 Kingsland Passaic County	570.7E 4521.0N	Suburban - Mobile, 7' above ground. Located on Route 3, east of Bloomfield Avenue.
Union City (052)	714 31st Street Hudson County	581.7E 4513.8N	Center City - Residential, 27' above ground. Located on the Health Dept. Bldg.
Elizabeth (056)	600 North Broad Street Union County	566.4E 4502.6N	Center City - Residential, 27' above ground. Located on the Mitchell Bldg.
New Brunswick (057 & 068)	12th Street & Livingston Ave. Middlesex County	544.4E 4480.0N	Suburban - Industrial, 8' above ground. Located adjacent to the Delco-Remy Plant. Filters are analyzed for metals. Collocated to TSP & Pb precision.
Newark (060 & 069)	Avenue C & Wright St. Essex County	569.8E 4507.5N	Center City - Commercial, 8' above ground. Located near Cookson Pigments Co. Filters analyzed for metals. Collocated for TSP & Pb precision.
Atlantic City (061)	Missouri & Baltic Aves. Atlantic County	548.2E 4356.8N	Center City - Commercial, 8' above ground. Located in the bus terminal parking lot.
Deepwater (062)	Chester Ave. east of Route 130 Salem County	458.0E 4392.4N	Rural - Industrial, 8' above ground. Located near Deepwater Generating Station and Dupont. Pump Station # 4. Analyzed for metals.
Paterson (N08)	176 Broadway Passaic County	570.0E 4529.6N	Center City - Industrial, 33' above ground. Located on the roof of the Health Department Bldg.
Phillipsburg (070)	Meyner Rd., Walters Park Warren County	485.6E 4503.7N	Urban-Residential, Industrial. Located on the roof of the pool house. Analyzed for metals.

APPENDIX F

AIR QUALITY GUIDELINE INFORMATION

APPENDIX F

AIR QUALITY GUIDELINE INFORMATION

The U.S. *EPA Guideline on Air Quality Models (Revised)* (EPA, 1996) lists the preferred EPA models for simulating air quality in simple and complex terrain for refined modeling analyses. Simple terrain is considered to be an area where terrain features are all lower in elevation than the top of the stack(s) in question. Table 4-1 of EPA's modeling guideline lists the preferred models to be used for simple terrain and further categorizes their use for short-term/long-term averaging times, source type, and land use. Further information about the Industrial Source Complex 3 (ISC3) model may be found in EPA (1995a); the Gaussian-plume multiple source air quality algorithm (RAM) in Turner and Novak (1978); and the Buoyant Line and Point (BLP) Source dispersion model in Schulman and Scire (1980). In most cases NJDEP prefers the use of the ISC3 when conducting refined modeling in simple terrain.

EPA released the SCREEN3 model (EPA, 1995b) for use in short-term screening modeling. SCREEN3, which runs interactively on a personal computer, can predict short-term impacts from a single source. SCREEN3 is capable of estimating maximum ground-level concentrations and the distance to the maximum, incorporating the effects of building downwash on the maximum concentrations for both the near wake and far wake regions, estimating concentrations in the cavity recirculating zone, estimating concentrations due to inversion break-up and shoreline fumigation, and determining plume rise for flare releases. The model can also estimate 24-hour average concentrations due to plume impaction in complex terrain using the VALLEY model 24-hour screening procedure.

Evaluations for long-term (monthly, seasonal, or annual) concentrations, such as the annual averaging periods of SO_2, PM-10, or NO_2, require the use of a model capable of predicting long-term averaging periods. Typically a model such as the ISCST3, the Industrial Source Complex Long-Term 3 (ISCLT3) model (EPA, 1995a) or the Climatological Dispersion Model (CDM) (EPA, 1985b) should be used for long-term predictions. If ISCST3 is being used to predict a source=s short-term impacts, it must also be used to predict its long-term concentrations. ISCLT3 has options to account for building downwash or for sources in either urban or rural areas. CDM may only be used in urban areas for GEP stacks. Stability wind rose (STAR) meteorological data (see Section 6.2) are used as input to ISCLT3 and CDM.

Complex terrain modeling should be used for terrain features greater than or equal to the top of the modeled stack(s). Five screening techniques are currently available to aid in the evaluation of concentrations due to plume impaction the VALLEY Screening Technique as outlined in the VALLEY User's Guide (EPA, 1977b), COMPLEX-I, SHORTZ/LONGZ, CTSCREEN (Perry, Burns, and Cimorelli, 1990) and the Rough Terrain Diffusion Model (RTDM) [ERT, 1987]. The EPA (1996) recommends that the VALLEY Screening Technique, COMPLEX-I, SHORTZ/LONGZ and RTDM be used only to calculate concentrations at receptors whose elevations are greater than or equal to plume height.The CTSCREEN model can be to estimate impacts at all receptors above stack height. Receptors below stack height should be modeled using a preferred simple terrain model. On a case-by-case basis, receptors between stack height and plume height (known as intermediate terrain) may be modeled with COMPLEX-I, SHORTZ/LONGZ or RTDM and a simple terrain model and the highest concentration each hour used. ISCST3 is capable of modeling the intermediate terrain with both a simple and complex terrain model when the complex terrain option is used. For the simple terrain models, terrain may have to be "chopped off" at stack height, since these models are frequently limited to receptors no greater than stack height.

The VALLEY Screening Technique should be used to determine 24-hour averages for a first-level screening analysis. In urban areas, the VALLEY model should be run in both the rural (2.5 m/s wind speed and F-stability) and urban mode (2.5 m/s wind speed and E-stability) and the highest of the predicted concentrations should be used. The VALLEY equivalent option in the COMPLEX-I model may be used for short term impacts in rural areas only. For annual averages, the VALLEY model should be used with 5 years of representative STAR data.

CTSCREEN uses an array of 204 predetermined meteorological conditions to estimate 1-hour, 3-hour, 24-hour, and annual impacts. The other complex terrain screening programs COMPLEX-I, SHORTZ-LONGZ, and RTDM require the use of hourly meteorological data.

The Complex Terrain Dispersion Model [CTDMPLUS] (EPA, 1989) is the refined complex terrain model. Use of this model requires the input of an extensive amount of detailed on-site meteorological data. Applicants should consult with NJDEP before proceeding with complex terrain modeling beyond initial Valley screening.

APPENDIX G

BUREAU OF AIR QUALITY EVALUATION=S

ODOR MODELING PROCEDURES

APPENDIX G

BUREAU OF AIR QUALITY EVALUATION'S ODOR MODELING PROCEDURES

The mechanisms of odorant dispersion in the atmosphere are the same as the dispersion of other pollutants. However, there are some special problems that must be considered when attempting to quantify a source=s odor impact with dispersion modeling. Among them are determining the emission rates of the odor-producing pollutants (odorants), the high degree of subjectivity in the perception and intensity of odors, the short time period over which odors are observed, and the enhancing or masking of odors by the combinations of odorants. In addition, there are no dispersion models or modeling techniques recommended by the USEPA for odor modeling.

N.J.A.C. 7:27-5 (Prohibition of Air Pollutants) states that a source will not emit air contaminants in such quantities and duration as to unreasonably interfere with the enjoyment of life or property. In addition, odor modeling may be required of a new, reconstructed, or modified municipal wastewater/sludge handling or treatment facility as described in the Air Quality Permitting Program=s document *Guidance Document for Odor Nuisance at Municipal Wastewater/Sludge Handling & Treatment Facilities*. Therefore, in spite of the problems, NJDEP does on occasion need to evaluate or review modeling of new or modified sources capable of causing odor problems. Although there is no USEPA guidance on the issue, there have been several scientific studies and technical papers written on the subject of odor modeling. The Bureau of Air Quality Evaluation (BAQEv) has reviewed the available literature and has developed guidance for assessing a source=s odor impact with dispersion modeling. Predictions made in an odor modeling analysis following this guidance would only be considered an indication of the future odor impact of the source, not the definitive answer. It should be considered a tool in setting either a dilution-to-threshold (D/T) odor emission limit or pound per hour pollutant specific emission rates for the source.

G.1 Odor Modeling Techniques

The BAQEv currently recommends two methods of modeling odor impacts. The method selected will be a function of the number of odor-producing pollutants emitted from the source. Regardless of the type of method used, the analysis must provide predictions of maximum odor impacts at sensitive receptors in the vicinity of the source. Sensitive receptors include, but are not limited to, residents of occupied homes and residential areas, employees and customers at industrial, commercial, or government establishments, schools, hospitals, and visitors at a recreational public place such as park or playground. Submittal of predicted odor frequency tables also provides useful information in the review of a source=s odor impacts. As with other air quality impact analyses, BAQEv requires that a protocol be submitted and approved before the odor modeling analysis is conducted.

G.1.1 Sources that Emit One Primary Odor Producing Pollutant

In this situation the interaction of pollutants masking or enhancing a perceived odor should be minimal. Therefore, the odor producing pollutant can be modeled by entering the pollutant=s emission rate in grams per second into the selected model. The model=s predicted concentration (in mass per volume, ug/m^3) can then be compared to the pollutant=s specific odor threshold.

G.1.2 Sources that Emit Several Odor Producing Pollutants (e.g. composting facility)

When there are numerous pollutants being emitted from a source there is a much higher potential for interactions where various odorants may mask or enhance a perceived odor. Therefore, a dilution to threshold (D/T) approach to quantifying odors should be used in the analysis. D/T is dimensionless and is a measure of how many volumes of odor-free air must be added to a sample of contaminated air in order to reduce its odor level below the detection level. The odor emission rate of the source is expressed as the product of the D/T in air directly emitted by the source and the volume flow rate. In order to obtain the correct magnitude of D/T, the model selected should be set to predict g/m^3, not ug/m^3.

In the measurement of a source=s D/T emission rate, the odorous air sample from the source is diluted with equal volumes of odor-free air until an odor is no longer perceptible. For example, an odorous air sample that was diluted with 100 volumes of odor-free air to reach the 50 percent odor perceptibility would have an odor level of 100 D/T.

G.2 Conversion of 1-Hour Modeled Concentrations to Short-term Averages

An odor modeling analysis can be conducted with either a puff (fluctuating plume) model or one of the standard Gaussian models recommended by the USEPA such as the Industrial Source Complex Short-term 3 (ISCST3) model or SCREEN3 models. If a puff type model such as TRC=s Odor Model or USEPA=s INPUFF model is used, no conversion is necessary because short-term D/T values or pollutant concentrations will be predicted by the model. However, if a model such as ISCST3 or SCREEN3 is used, predicted one-hour D/T or pollutant concentration need to be converted to short-term peak values of 5 minutes or less.

Review of the available literature indicates the relationship between a 1-hour concentration and a short-term peak concentration such as a five minute average is a function of meteorology (principally atmospheric stability), the release height of emissions, the distance from the source to receptor, building downwash, and surface roughness. In the paper *A Conversion Scheme for ISC Model In Odor Modeling* (Samuel S. Cha, Zhenjia Li, and Karen E. Brown, 1992. AQMA 85th Meeting, 92-153.02) a technique is developed for converting 1-hour concentrations to 5-second concentrations for point sources. Conclusions reached in the paper indicate that the peak/mean ratios depend on the meteorological condition, the type of source and the receptor location. A summary of their results for point sources with a 20 meter plume height and a 40 meter plume height are given in Table G-1. The paper *Odor Modeling - Why and How* (Duffee, R.A., M. A. O=Brien, and M. Ostojic, 1989. AWMA Specialty Conference) compares 1-hour ISCST predictions to the instantaneous predictions of the INPUFF model. When modeling an area source during stable conditions, a relatively constant conversion ratio of approximately 7 was found at receptor distances of 0.8 km, 1.6 km, and 2.4 km.

Though often too simplistic, another method of converting values to shorter averaging times is the power law relationship. The following is an example of using the power law to convert a 1-hour concentration or D/T value to a five minute average:

$Cp = Cm\,(t_m/t_p)^{0.2}$ where: Cp = 5-minute average concentration or D/T
Cm= 1-hour average concentration or D/T
t_p = 5 minutes
t_m = 60 minutes

An applicant planning to conduct odor modeling with a model similar to ISCST3 or SCREEN3 can suggest the use of a conversion ratio based on the above discussion or propose their own. BAQEv will review the proposed conversion ratios in the modeling protocol before they are approved for use in the analysis.

G.3 Odor Modeling Results

Once short-term pollutant concentrations have been calculated, they must be compared to odor detection and complaint levels. Odor detectability, or the odor threshold, is usually defined as the point at which 50 percent of a given population will perceive an odor. Table G-2 lists some of the published odor detection levels of pollutants that often cause odor problems. Odor complaint levels are usually 2 to 3 times higher than the odor threshold levels. The Connecticut Department of Environmental Protection odor limits given in Table G-2 are considered nuisance levels. Applicable odor detection and complaint levels for odor producing emissions from a proposed source should be discussed in the modeling protocol.

Based on the results of the modeling, a D/T emission limit at the source is set which ensures offsite D/T values will be at an acceptable level. The only odor limit specified by NJDEP is contained in the document *Guidance Document for Odor Nuisance at Municipal Wastewater/Sludge Handling & Treatment Facilities*. The document is part of the State-of-the-Art (SOTA) Manual for Municipal Wastewater/Sludge Handling and Treatment Facilities. It states that emissions of odor-causing compound(s) from a new, reconstructed, or modified source will have an odor intensity of less than 5 D/T at the sensitive receptor with the highest impact. Once the D/T emission limit has been set for a facility, it can later be verified by source testing when the facility is built.

TABLE G-1. Conversion Factors for Peak-To-Mean Ratio

Distance (m)	B Stability: Wind Speed: 2 m/s (4.5 mi/hr)	D Stability: Wind Speed: 6 m/s (13.4 mi/hr)	E Stability: Wind Speed: 2 m/s (4.5 mi/hr)
Case I: Point Source Plume Height = 40 Meters			
100	45.0	6.0	8.3
200	38.5	7.3	8.3
300	23.2	8.5	10.1
400	16.1	10.2	10.9
600	12.8	12.4	12.7
800	12.6	13.3	13.1
1,000 (0.62 mi)	12.4	10.2	15.6
Case II: Point Source Plume Height = 20 Meters			
100	36.0	6.0	5.6
200	14.7	9.7	7.8
300	11.6	12.6	10.9
400	11.0	10.3	12.6
600	10.8	7.4	10.9
800	10.6	6.7	8.4
1,000 (0.62 mi)	10.4		7.3

TABLE G-2. Published Odor Thresholds

Odorant	Odor Threshold [a] (ug/m^3)	Odor Limit [b] (ug/m^3)	Odor Threshold [c] (ug/m^3)	Odor Detection [d] (ug/m^3)
Acetaldehyde	120	-----	90	90
Ammonia	-----	-----	3,615	3,700
Carbon Disulfide	-----	-----	342	3,900
Dimethyl Disulfide	-----	-----	-----	66
Dimethyl Sulfide	-----	-----	-----	51
Hydrogen Sulfide	-----	6.3	11.3	5.5
Methyl Mercaptan	-----	2.2	3.4	2.4
Phenol	230	461	153	500
Styrene	640	638	1,360	1,300
Trimethyl Amine	-----	-----	1.1	6

(a) Geometric mean of all odor threshold detection levels in literature reviewed by authors, values from *Reference Guide to Odor Thresholds for HAPS Listed in the Clean Air Act Amendments of 1990* (Draft), 1991, TRC Environmental Consultants

(b) Connecticut DEP - 15 minute average of concentration considered a nuisance

(c) Geometric mean of all odor threshold detection levels in literature reviewed by authors: AOdor as an Aid to Chemical Safety: Odor Thresholds Compared with TLV and Volatibilities for 214 Industrial Chemicals in Air and Water Dilution@ from *Journal of Applied Toxicology* Vol. 3 No. 6, 1983

(d) Represents the 50 percent detection level: AThe Odor Impact Model@ from *Journal of Air and Waste Management* Vol. 41 No. 10, October 1991